# CITY OF SAN JOSE

## 2019 Inventory of Community-wide Greenhouse Gas Emissions

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CLIMATE SMART
SAN JOSE
LIVING BETTER TODAY FOR TOMORROW

# Credits and Acknowledgements


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# Abbreviations

| | |
|---|---|
| ACE | Altamont Corridor Express |
| Btu | British thermal units |
| Cal e-GGRT | CARB Electronic Greenhouse Gas Reporting Tool |
| CalRecycle | California Department of Resources Recycling and Recovery |
| CARB | California Air Resources Board |
| CED | Community Energy Department |
| CFCs | Chlorofluorocarbons |
| CFMP | Community Forest Management Plan |
| $CH_4$ | Methane |
| Climate Smart | Climate Smart San José |
| CNG | Compressed natural gas |
| $CO_2$ | Carbon dioxide |
| $CO_2e$ | Carbon dioxide equivalent |
| CPUC | California Public Utilities Commission |
| CRF | Global Covenant of Mayors Common Reporting Framework |
| C&D | Construction & demolition |
| DOT | Department of Transportation |
| eGRID | Emissions & Generation Resource Integrated Database |
| EIA | U.S. Energy Information Administration |
| ESD | Environmental Services Department |
| EV | Electric vehicle |
| FAA ATADS | Federal Aviation Administration Air Traffic Activity System |
| FLIGHT | U.S. EPA Facility Level Information on Greenhouse Gases Tool |
| FY | Financial year |
| g | Grams |
| GGE | Gallons of gas equivalent |
| GHG | Greenhouse gas |
| GHGRP | U.S. EPA Greenhouse Gas Reporting Program |
| GIS | Geographic Information System |
| Google EIE | Google Environmental Insights Explorer |
| GPC | Global Protocol for Community-Scale Greenhouse Gas Emission Inventories |
| GSE | Ground Support Equipment |

# Abbreviations, continued

| | |
|---|---|
| GWh | Gigawatt-hours (1,000,000,000 watt-hours) |
| GWP | Global warming potential |
| HCFCs | Hydrochlorofluorocarbons |
| HFCs | Hydrofluorocarbons |
| ICLEI | ICLEI - Local Governments for Sustainability USA |
| IPCC | Intergovernmental Panel on Climate Change |
| IWM | Integrated Waste Management Division |
| kg | Kilograms |
| lbs | Pounds |
| LBNL | Lawrence Berkeley National Lab |
| LEARN | ICLEI Land Emissions And Removals Navigator |
| LMOP | U.S. EPA Landfill Methane Outreach Program |
| LPG | Liquefied petroleum gas |
| MMBtu | Million British thermal units |
| mph | Miles per hour |
| MRR | California Regulation for the Mandatory Reporting of Greenhouse Gas Emissions |
| MSW | Municipal solid waste |
| MT | Metric tons |
| MWh | Megawatt hours (1,000,000 watt hours) |
| $NF_3$ | Nitrogen trifluoride |
| NLCD | National Land Cover Database |
| $N_2O$ | Nitrous oxide |
| PEIR | Program Environmental Impact Review |
| PeMS | California Department of Transportation Performance Measurement System |
| PFCs | Perfluorocarbons |
| PG&E | Pacific Gas and Electric |
| PWD | Public Works Department |
| RHV | Reid-Hillview County Airport |
| scf | Standard cubic feet |
| $SF_6$ | Sulfur hexafluoride |
| SJC | Norman Y. Mineta San José International Airport |
| SJCE | San José Clean Energy |
| SJSU | San José State University |
| SUMC | Shared Use Mobility Center |

# Abbreviations, continued

| | |
|---|---|
| USCP | U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions |
| U.S. EPA | U.S. Environmental Protection Agency |
| UWMP | Urban Water Management Plan |
| VMT | Vehicle miles traveled |
| VTA | Santa Clara Valley Transportation Authority |
| WARM | U.S. EPA Waste Reduction Model |
| Wastewater Facility | San José-Santa Clara Regional Wastewater Facility |
| Z-Best | Z-Best Composting Facility |
| ZWED | ZeroWaste Energy Development |

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# EXECUTIVE SUMMARY

The City of San José ("City") recognizes that greenhouse gas (GHG) emissions from human activity are causing profound climate change, the consequences of which pose substantial risks to the future health, well-being, and prosperity of our community. Furthermore, San José has multiple opportunities to benefit by acting quickly to reduce community GHG emissions. Actions to reduce GHG emissions can have many local benefits, such as reducing energy and transportation costs for residents and businesses, creating green jobs, improving health of residents, and making the community a more attractive place to live and locate a business. San José's goals for reducing GHG emissions are laid out in the Climate Smart San José (Climate Smart) plan, which also contains a set of strategies to guide the City in reducing community-wide GHG emissions and helping to meet the goals of the Paris Agreement.

This report provides estimates of community-wide GHG emissions in the City of San José in calendar year 2019 and compares them to updated versions of previously completed GHG inventories – for 2008, 2014 and 2017.

## Key findings

Figure ES-1 provides a breakdown of community-wide emissions by sector in 2019. The largest contributor is the transportation sector, which comprises 51 percent of total emissions. The next largest contributor is the buildings sector (primarily electricity and natural gas usage), comprising 34 percent of total emissions. Process and fugitive emissions, solid waste, and wastewater treatment are responsible for the remainder of community-wide emissions. A breakdown of the 2019 inventory by sector and subsector is provided in Table ES-1, along with the percent decrease in each sector and subsector since 2017. The Inventory Results section of this report provides a detailed profile of emissions in 2019 – key information for guiding future reduction efforts.

San José community-wide emissions totaled 5,477,619 metric tons of carbon dioxide equivalent (MT $CO_2$e) in 2019 and sequestration by trees and forests totaled 65,465 MT $CO_2$e, leading to net emissions of 5,412,154 MT $CO_2$e.

***Figure ES-1*** *2019 San José community-wide emissions by sector*

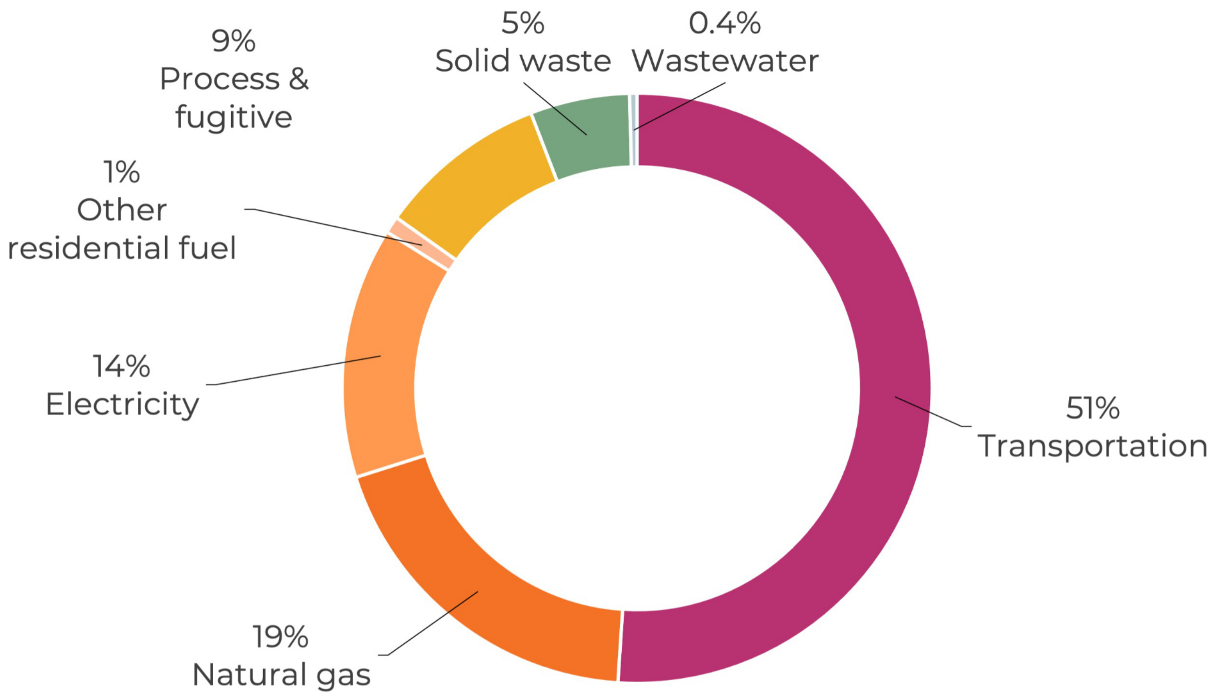


***Table ES-1*** *2019 community-wide emissions in San José and change since the previous inventory (2017)*

| Emission sector/subsector | 2019 emissions (MT $CO_2e$) | Percent change from 2017 |
|---|---|---|
| Transportation | 2,795,791 | - 9% |
| *On-road vehicles* | *2,463,769* | *- 10%* |
| *Off-road vehicles* | *161,865* | *- 1%* |
| *Aviation – non-local flights* | *135,343* | *+ 11%* |
| *Buses and paratransit* | *15,066* | *- 12%* |
| *Freight rail* | *11,539* | *+ 33%* |
| *Commuter rail* | *3,878* | *- 4%* |
| *Aviation – local flights* | *3,810* | *- 16%* |
| *Light rail* | *521* | *- 55%* |
| Buildings | 1,850,231 | + 2% |
| *Natural gas* | *1,045,209* | *+ 6%* |
| *Electricity* | *753,963* | *- 4%* |
| *Other residential fuels* | *51,059* | *+ 8%* |
| Process and fugitive emissions | 510,579 | - 1% |
| *Fugitive HFCs and PFCs* | *464,753* | *- 1%* |
| *Fugitive natural gas* | *42,088* | *+ 1%* |
| *Fugitive $SF_6$* | *3,738* | *- 25%* |
| Solid waste | 298,733 | - 8% |
| *Construction & demolition (C&D)/other* | *151,379* | *- 10%* |
| *Residential* | *86,771* | *- 11%* |
| *Commercial* | *60,583* | *+ 4%* |
| Wastewater treatment | 22,285 | - 2% |
| **Total emissions** | **5,477,619** | **- 5%** |
| Forest and urban trees | -65,465 | + 5% |
| **Net Emissions** | **5,412,154** | **- 5%** |

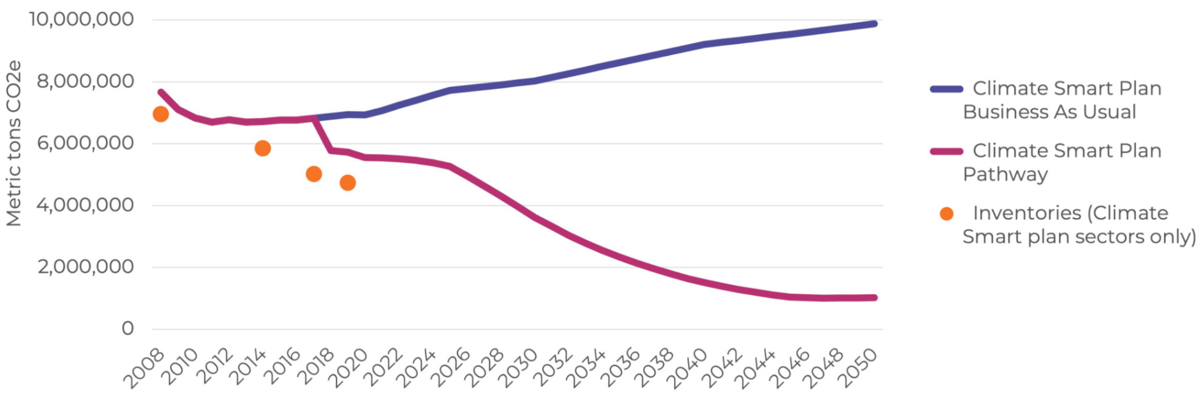
This inventory follows an updated methodology compared to previous inventories in order to meet the guidelines of the Global Covenant of Mayors Common Reporting Framework[1], released in 2018, and the updated U.S.

[1] Global Covenant of Mayors for Climate & Energy, 2018. Global Covenant of Mayors Common Reporting Framework Version 6.1. https://www.globalcovenantofmayors.org/our-initiatives/data4cities/common-global-reporting-framework/

Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions[2], released in 2019. As a result, it includes multiple emissions sources that were not considered in the Climate Smart plan: electricity transmission and distribution losses; aviation; freight rail; industrial process emissions; fugitive natural gas; fugitive sulfur hexafluoride ($SF_6$); and fugitive hydrofluorocarbons (HFCs) and perfluorocarbons (PFCs). It also includes carbon sequestration by trees, which was not considered in the Climate Smart plan. When including only sectors that were considered in the Climate Smart plan, San José community-wide emissions totaled 4,747,759 MT $CO_2$e in 2019.

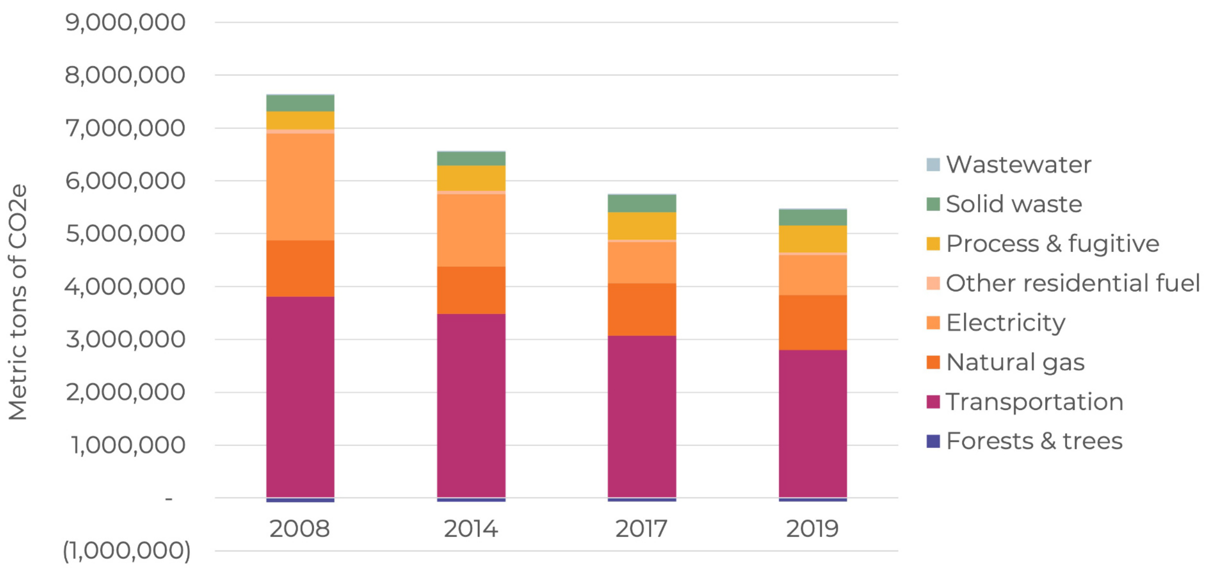
The Climate Smart plan lays out a pathway for emissions reduction until 2050 that is based on the goals in the Paris Agreement and in California Executive Order S-03-05. The pathway goal for 2019 is 5,727,275 MT $CO_2$e. San José 2019 emissions from only the sectors considered in the Climate Smart plan are 979,516 MT $CO_2$e lower than the Climate Smart pathway goal. Figure ES-2 provides a comparison between the Climate Smart emissions reduction pathway and San José emissions reduction progress so far. Figure ES-3 provides a comparison between the emissions sector breakdown in 2019 and in previous inventory years.

***Figure ES-2*** *Climate Smart emissions reduction pathway and San José emissions reduction progress so far*




[2] ICLEI – Local Governments for Sustainability USA, 2019. U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions Version 1.2. https://icleiusa.org/us-community-protocol/

***Figure ES-3*** *Comparison of all San José community-wide GHG inventories, broken down by sector*



# Climate Change Background

Overwhelming evidence shows that human activities are rapidly increasing the atmospheric concentration of GHGs and thereby changing the global climate. The Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) states that "warming of the climate system is unequivocal."[3] Furthermore, the report finds that "most of the observed increase in global average temperatures since the mid-20th century is very likely due to the observed increase in anthropogenic GHG concentrations."

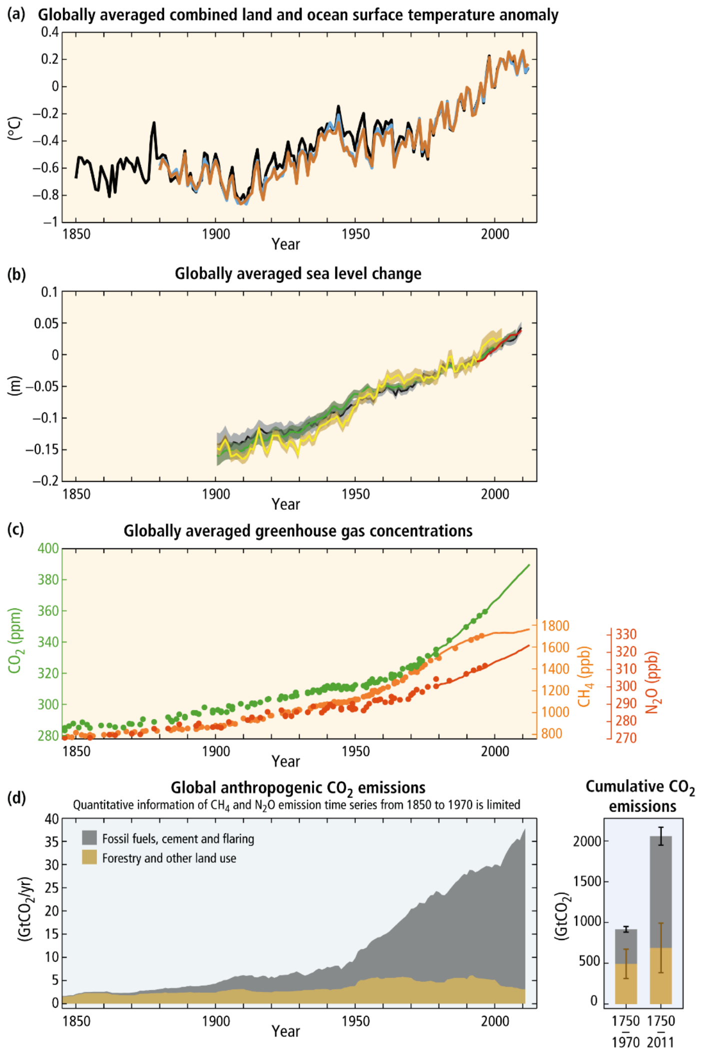



***Figure 1** Indicators of a changing global climate system*[4]

[3] IPCC, 2007: Climate Change 2007: Synthesis Report. Contribution of Working Groups I, II and III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, Pachauri, R.K and Reisinger, A. (eds.)]. IPCC, Geneva, Switzerland, 104 pp.

[4] IPCC, 2014: Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, R.K. Pachauri and L.A. Meyer (eds.)]. IPCC, Geneva, Switzerland, 151 pp.

Globally, the past decade, 2009-2019, had the hottest years on record, with 2016 being the warmest year and 2019 being the second warmest year ever.[5] The steady uptick in average temperatures (see Figure 1) is significant and expected to continue if action is not taken to greatly reduce GHG emissions.

San José is expected to face multiple impacts of climate change over the coming decades, including more frequent and extreme heat events and water shortages, increased wildfire risk, and disruption of ecosystems, habitats, and agricultural activities. Actions are already being taken to mitigate these impacts (such as the U.S. Army Corps of Engineers' South San Francisco Bay Shoreline Phase I project, which will protect the city from rising sea levels), but more needs to be done.

Reducing fossil fuel use in the community can have many benefits in addition to reducing GHG emissions. Switching to energy sources that emit less GHGs and to appliances, vehicles, and equipment that use energy more efficiently decreases utility and transportation costs for both residents and businesses. Retrofitting homes and businesses to be all-electric and more efficient creates local jobs. In addition, money not spent on energy is more likely to be spent at local businesses and added to the local economy. Improving our active transportation and public transit infrastructure and densifying our city reduce the need to drive and reduce the distances of everyday trips, improving residents' access to needed services and reducing the time that residents spend sitting in traffic. Reducing fossil fuel use improves air quality, both indoors and outdoors, and switching from driving to walking and bicycling improves residents' health.

[5] Fountain, Henry, and Nadja Popovich. "2019 Was the Second-Hottest Year Ever, Closing Out the Warmest Decade." The New York Times, The New York Times, 15 Jan. 2020, www.nytimes.com/interactive/2020/01/15/climate/hottest-year-2019.html.

# Inventory Methodology

## Protocols

This inventory follows, as much as possible, the guidelines of three protocols: the Global Protocol for Community-Scale Greenhouse Gas Emission Inventories (GPC)[6], the Global Covenant of Mayors Common Reporting Framework (CRF)[7] and the U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions (USCP)[8]. Table 1 compares the sectors included in this inventory with the requirements of the three protocols.

Ways in which this inventory deviates from protocol guidelines:

**GPC - BASIC guidelines**

- Should use location-based electricity emission factors (e.g. for California grid) - this inventory uses utility emission factors instead
- Should include off-road transportation on industrial, construction sites in the Stationary Energy sector – in this inventory, it is included in the Transportation sector
- Should include grid electricity used by aircraft in the Transportation sector – in this inventory, it is included in the Buildings sector

**CRF guidelines**

- Should separate out public/institutional buildings – possible for PG&E data but not for San José Clean Energy (SJCE) data
- Should include wastewater treatment energy use in the Stationary Energy sector – in this inventory, it is included in the Wastewater treatment sector
- Should include wastewater treatment process emissions in the Waste sector - in this inventory, they are included in the Wastewater treatment sector

[6] World Resources Institute, 2014. Global Protocol for Community-Scale Greenhouse Gas Emission Inventories. https://ghgprotocol.org/greenhouse-gas-protocol-accounting-reporting-standard-cities

[7] Global Covenant of Mayors for Climate & Energy, 2018. Global Covenant of Mayors Common Reporting Framework Version 6.1. https://www.globalcovenantofmayors.org/our-initiatives/data4cities/common-global-reporting-framework/

[8] ICLEI – Local Governments for Sustainability USA, 2019. U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions Version 1.2. https://icleiusa.org/us-community-protocol/

**USCP guidelines**

- Should separate out electricity used for electric vehicle (EV) charging if possible – we lack data to do this
- Should include wastewater treatment energy use in the Industrial sector – in this inventory, it is included in the Wastewater treatment sector

***Table 1*** *Sectors and subsectors included in this inventory, compared to the requirements of three standard GHG inventory protocols. For the CRF, sectors excluded for being insignificant should not add up to more than 5 percent of total emissions.*

| Sector/subsector | This inventory | GPC – BASIC | CRF | USCP |
|---|---|---|---|---|
| Transportation | | | | |
| *On-road vehicles* | *included* | *required* | *required* | *required* |
| *Aviation – non-local flights* | *included* | *optional* | *optional* | *optional* |
| *Off-road vehicles* | *included* | *required* | *required if significant* | *optional* |
| *Aviation – local flights* | *included* | *required* | *required if significant* | *optional* |
| *Buses and paratransit* | *included* | *required* | *required* | *required* |
| *Freight rail* | *included* | *required* | *required* | *optional* |
| *Commuter rail* | *included* | *required* | *required* | *optional* |
| *Light rail* | *included* | *required* | *required* | *optional* |
| *Boats* | *not included* | *required* | *required if significant* | *optional* |
| Buildings | | | | |
| *Natural gas* | *included* | *required* | *required* | *required* |
| *Electricity* | *included* | *required* | *required* | *required* |
| *Other residential fuels* | *included* | *required* | *required* | *required* |
| Process and fugitive | | | | |
| *Fugitive HFCs and PFCs* | *included* | *optional* | *optional* | *optional* |
| *Fugitive natural gas* | *included* | *optional* | *optional* | *optional* |
| *Fugitive* $SF_6$ | *included* | *optional* | *optional* | *optional* |
| Solid waste | included | required | required | required |
| Wastewater treatment | included | required | required | required |
| Forests and trees | included | optional | optional | optional |
| Water delivery | included | no guidance | no guidance | required |
| Electricity generated for supply to the electric grid | included | no guidance | required | optional |

## Boundary

For different inventory sectors in a community-wide inventory, there are different standards for what emissions should be included. For instance, all emissions occurring within the city limits boundary should be included for some sectors, and all emissions resulting from the activities of city residents for other sectors. In some cases, cities have leeway to decide what to include. Table 2 indicates the boundaries for what is included in this inventory.

***Table 2*** *Emissions included in each inventory subsector (continued on next page)*

| Sector/subsector | Included | Excluded |
|---|---|---|
| Transportation | | |
| *On-road vehicles* | *Emissions from all in-boundary trips, and 50% of trips starting or ending outside city boundary* | *Emissions from all pass-through trips (trips starting and ending outside city boundary)* |
| *Aviation – non-local flights* | *50% of emissions from flights into or out of Reid-Hillview Airport (RHV); Emissions from taxi, take-off, and landing of passengers departing or arriving at SJC* | *Emissions from connecting passengers at SJC* |
| *Off-road vehicles* | *All in-boundary emissions* | |
| *Aviation – local flights* | *All in-boundary emissions* | |
| *Buses and paratransit* | *All in-boundary emissions* | |
| *Freight rail* | *All in-boundary emissions* | |
| *Commuter rail* | *All in-boundary emissions* | |
| *Light rail* | *All in-boundary emissions* | |
| Buildings | | |
| *Natural gas* | *All in-boundary emissions* | |
| *Electricity* | *All emissions associated with electricity used in-boundary* | |
| *Other residential fuels* | *All in-boundary emissions* | |
| Process and fugitive | | |
| *Fugitive HFCs and PFCs* | *All in-boundary emissions* | |
| *Fugitive natural gas* | *All in-boundary emissions* | |
| *Fugitive $SF_6$* | *All emissions associated with in-boundary electricity use* | |

***Table 2** continued*

| Sector/subsector | Included | Excluded |
|---|---|---|
| Solid waste | Emissions from all waste generated in-boundary | Emissions from waste generated outside San José but disposed of in San José |
| Wastewater treatment | Emissions from all wastewater generated in-boundary | Emissions from wastewater generated outside San José but treated in San José |
| Forests and trees | Emissions and sequestration by in-boundary forests and trees | |
| Water delivery | Emissions associated with treatment and delivery of potable water used in San José | |
| Electricity generated for supply to the electric grid | Emissions from in-boundary power plants | |

## Emission scopes

In the GPC framework, emissions in community-wide inventories are categorized by scope. The scope framework allows emissions from multiple jurisdictions or locations to be added up without double counting. There are three emissions scopes:

**Scope 1:** In-boundary emissions. Examples include tailpipe emissions from vehicles, and emissions from natural gas furnaces in buildings.

**Scope 2:** Indirect emissions associated with the consumption of purchased or acquired electricity, steam, heating, or cooling.

**Scope 3:** Out-of-boundary emissions not covered in Scope 2. Examples include emissions from out-of-boundary portions of transboundary vehicle trips and emissions associated with disposal of residents' waste outside the city boundary.

This inventory includes all Scope 1 and Scope 2 emissions sectors, and some Scope 3 emissions sectors.

## History of previous inventories

Three community-wide inventories were conducted before this one, covering emissions in calendar years 2008, 2014, and 2017.

The 2008 community-wide inventory was prepared by Sierra Research as part of the Program Environmental Impact Review (PEIR) for the Envision San José 2040 General Plan. It was published in 2011 in Appendix K-3 of the Draft PEIR, the Greenhouse Gas Reduction Strategy. This inventory included transportation; electricity and natural gas use in buildings; and waste. The Greenhouse Gas Reduction Strategy was updated in 2015, but the 2008 inventory was not updated.

The 2014 community-wide inventory was prepared by staff from AECOM, David J. Powers & Associates, and Hexagon Transportation Consultants in collaboration with City of San José staff as part of the PEIR Addendum associated with the Envision San José 2040 General Plan 4-Year Review Amendments. It was published in 2016 in Appendix D to the Addendum, the Community-wide Emissions Inventory and Forecasts Memorandum. This inventory followed the USCP version 1.1 and included transportation; electricity and natural gas use in buildings; solid waste; wastewater treatment; and potable water production, treatment, and delivery.

The 2017 community-wide inventory was prepared by ICLEI - Local Governments for Sustainability USA (ICLEI) and published in 2019. It followed the GPC and USCP and included transportation; electricity and natural gas use in buildings; solid waste; wastewater treatment; potable water production, treatment, and delivery; and fugitive natural gas emissions. In the transportation sector, it included emissions from light rail, public transit buses, and in-boundary airport flights, which had not previously been estimated. It also included an update of the 2014 inventory to correct mistakes in the 2014 inventory's methodology for wastewater treatment emissions and to estimate fugitive natural gas emissions for 2014.

Table 3 compares the sectors and subsectors included in this inventory and the original previous three inventories. In the process of compiling this inventory, all three previous inventories were also updated to match this inventory's methodology. The updated data and calculations are provided in the Appendix.

***Table 3*** *Sectors and subsectors included in this inventory as compared to previous inventory reports. Sectors and subsectors that were included are marked with an "X".*

| Sector/subsector | 2008 inventory published in 2011 | 2014 inventory published in 2016 | 2017 inventory published in 2019 | This report |
|---|---|---|---|---|
| Transportation | | | | |
| *On-road vehicles* | X | X | X | X |
| *Aviation – non-local flights* | | | | X |
| *Off-road vehicles* | X | X | X | X |
| *Aviation – local flights* | | | X | X |
| *Buses and paratransit* | | | X | X |
| *Freight rail* | | | | X |
| *Commuter rail* | X | X | X | X |
| *Light rail* | | | X | X |
| *Boats* | X | X | X | |
| Buildings | | | | |
| *Natural gas* | X | X | X | X |
| *Electricity* | X | X | X | X |
| *Other residential fuels* | | | | X |
| Process and fugitive | | | | |
| *Fugitive HFCs and PFCs* | | | | X |
| *Fugitive natural gas* | | | X | X |
| *Fugitive $SF_6$* | | | | X |
| Solid waste | X | X | X | X |
| Wastewater treatment | X | X | X | X |
| Forests and trees | | | | X |
| Water delivery | unclear | X | X | X |
| Electricity generated for supply to the electric grid | | | | X |

## Quantification methods

Greenhouse gas emissions can be quantified in two ways:

**Measurement-based methodologies** refer to the direct measurement of greenhouse gas emissions (using a monitoring system), for instance from a power plant, wastewater treatment plant, landfill, or industrial facility.

**Calculation-based methodologies** calculate emissions using activity data and emission factors. The basic equation used to calculate emissions is:

*Activity Data x Emission Factor = Emissions*

All emissions in this inventory were quantified using calculation-based methodologies. Activity data refers to the measurement of GHG-generating processes, such as fuel consumption by fuel type, metered electricity consumption, and vehicle miles traveled.

Emission factors, often national averages, are used to convert energy usage or other activity data into associated quantities of emissions. Emission factors are expressed in terms of emissions per unit of activity data (for example, kilograms of $CO_2$ per megawatt hour (MWh) of electricity).

To prepare this inventory, emissions of carbon dioxide ($CO_2$), methane ($CH_4$), nitrous oxide ($N_2O$), HFCs, PFCs, and $SF_6$ were calculated. The CRF protocol also requires nitrogen trifluoride ($NF_3$) emissions to be reported, but no significant sources of $NF_3$ are known to exist in San José. Emissions of all non-$CO_2$ gases (with the exception of solid waste emissions) were converted into $CO_2e$ using global warming potential (GWP) values from the IPCC's Fifth Assessment Report.[9] $CO_2e$ values represent the amount of carbon dioxide that would lead to the same amount of warming as a given amount of methane or other GHG, and are used to make GHG emissions easier to summarize and compare.

Calculations for this inventory were made using a new spreadsheet built specifically for San José GHG inventories. See the Appendix for a detailed description of the activity data, emissions factors, GWP values, and calculation methods used in composing this inventory. Grand totals presented in this report differ in some cases from summed subsector totals due to rounding.

[9] IPCC, 2014: Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, R.K. Pachauri and L.A. Meyer (eds.)]. IPCC, Geneva, Switzerland, 151 pp.

## Inventory sectors not included

Emissions from backup power generators and accidental fires were excluded due to lack of data. Emissions from agriculture and boats were excluded because they are expected to be an insignificant source of emissions (less than 5 percent of the inventory total, combined).

## Data quality and uncertainties

The accuracy of a GHG inventory depends on the accuracy of the activity data and emission factors upon which it is based. Data errors, incomplete or missing data, inaccurate estimates, and inaccurate emission factors can all limit inventory accuracy. In this inventory, possible sources of error include:

- **Estimate of emissions from nitrification and denitrification during wastewater treatment.** In the absence of detailed data, the amount of nitrogen from industrial and commercial wastewater was assumed to be one quarter of the amount of nitrogen from sewage (a default value). Actual data on industrial and commercial wastewater would likely yield a different value.

- **Emissions estimates scaled down from statewide or regional values.** For some sectors, data exist at the statewide or regional level but not at the local level, so available emissions estimates were scaled down to San José based on number of jobs, population, or other scaling factors. These estimates are rough but the best currently possible.

- **Limited information on industrial process emissions.** Data on GHGs released by industrial processes in San José were taken from the U.S. Environmental Protection Agency's Facility Level Information on Greenhouse Gases Tool (U.S. EPA FLIGHT) tool, which publishes data collected by the U.S. EPA through its Greenhouse Gas Reporting Program (GHGRP). Only large direct emitters are required to report through this program, and so emissions from facilities emitting less than the reporting threshold are not captured here.

- **Limited information on emissions from natural gas used to generate electricity on-site.** As of 2020, PG&E does not include natural gas used to generate electricity in the natural gas usage data it supplies to municipalities. While natural gas used in power plants should not be included in GHG inventory totals to prevent double counting (as the emissions from this natural gas are already accounted for in grid and utility electricity emission factors), natural gas is also used to generate electricity on-site at some facilities. Data for these facilities were taken from the California Air Resources Board (CARB) Pollution Mapping Tool, which publishes data collected by CARB through the Mandatory GHG Reporting program. As with U.S. EPA emissions data, only large direct emitters are required to report to CARB, and so emissions from facilities emitting less than the reporting threshold are not captured here.

- **Estimate of emissions from on-road transportation.** Emissions from on-road transportation are extremely difficult to estimate because accurate estimation requires detailed knowledge of both activity data (traffic patterns) and the makeup of the vehicle fleet (the makes and models of the vehicles on the road). For the 2008 and 2014 inventories, activity data were estimated using the City's travel demand model, which was validated with traffic survey data in 2008 and 2015. Because the City's travel demand model has not been validated with real-world data since 2015, emissions data for 2019 were taken from the Google Environmental Insights Explorer (Google EIE), and emissions for 2017 were estimated by interpolation between 2014 and 2019 emissions estimates. This is the only sector in this report for which the same methodology was not used for all inventory years, because appropriate quality data was not available from any source for all years. Google EIE is relatively new and as of yet it is not clear how its estimates of vehicle activity data differ from those of the City's travel demand model.

- **Estimate of emissions from non-local flights.** Estimating emissions from aircraft taxi, take-off, and landing requires detailed analysis of airport flight operations data. The City did not have sufficient capacity to do this detailed analysis for SJC flights for all four inventory years; instead, 2018 SJC flight emissions estimates using this method, from the SJC Airport Master Plan Environmental Impact Report published in 2019, were scaled to estimate SJC flight emissions in 2008, 2014, 2017, and 2019. Emissions were scaled based on number of flights arriving at and departing from SJC. This method assumes that the aircraft fleet composition remained constant over time, and thus likely underestimates emissions in earlier years, as commercial aircraft fleets have generally improved in fuel efficiency over time.

- **Limited information on solid waste.** Accurate estimates of emissions from the disposal of solid waste (trash) require detailed information on the material composition of the waste – how much of it is food waste, for instance, or newspaper. This is because different materials decompose at different rates and release different amounts of GHGs as they decompose. The City collects detailed data on waste tonnages by sector (e.g., residential, commercial), but detailed material characterization data is not available for every year and not all disposed waste is covered by reported data. Waste tonnages by material were estimated as best as possible using the data available.

- **Limited information on forest and tree cover.** Estimates of emissions and sequestration by forests within San José city limits were calculated based on data from the National Land Cover Database (NLCD). When this inventory was being prepared, the most recent NLCD dataset available was for 2016. Forest emissions and sequestration for 2017 and 2019 were estimated as being equal to 2014 values. Estimates of emissions and sequestration by urban trees within San José were calculated based on U.S. Forest Service maps of urban canopy cover for 2012 and 2018. Tree canopy estimates from these maps were used to calculate the average gain and loss of tree canopy per year in that time period. Detailed urban canopy cover maps are not freely available for any other years.

- **Emission factors.** Many of the emission factors used in this inventory are default or average emission factors that may not exactly capture local conditions. For example, the $CH_4$ and $N_2O$ emission factors for electricity generation in this inventory are average values based on data for all power plants in California. For this reason, all of the emission calculations in this inventory should be seen as estimates, which would likely differ from direct measurements of emissions.

This inventory was completed as accurately as currently possible. Our hope is for each future community-wide inventory to be more accurate than the last, thanks to improvements over time in City data capabilities and inventory methodologies.

# San José 2019 Community-wide Inventory Results

## Emissions by scope

As described in the Inventory Methodology section, scopes are used to categorize emissions to avoid double counting within and between entities. Table 4 lists San José government operations emissions for 2019 by scope. $CO_2$ sequestration by forests and trees in San José (estimated at 65,465 MT $CO_2e$), although reported in this inventory, is not accounted for in Table 4.

***Table 4*** *2019 City of San José community-wide emissions by scope*

| Scope | 2019 emissions (MT $CO_2e$) | Percent of total | Emission sources included |
|---|---|---|---|
| Scope 1 | 4,291,137 | 78% | • Combustion of natural gas and other fuels in buildings and facilities<br>• Combustion of natural gas, fuel oil, and biogas for wastewater treatment<br>• Wastewater treatment process emissions<br>• Combustion of fuel in vehicles, trains, and off-road equipment within city boundary<br>• Combustion of fuel on local flights<br>• Fugitive natural gas, HFCs, PFCs, and $SF_6$<br>• Industrial process emissions<br>• Waste from San José residents, treated or disposed of within city boundary |
| Scope 2 | 721,647 | 13% | • Electricity used in buildings and facilities (includes EV charging)<br>• Electricity used for wastewater treatment<br>• Electricity used for light rail |
| Scope 3 | 464,835 | 9% | • Waste from San José residents, treated or disposed of outside city boundary<br>• Combustion of fuel on non-local flights<br>• Combustion of fuel in vehicles outside the city boundary on trips that originated or ended in San José<br>• Electricity lost during transmission and distribution |
| **Total** | **5,477,619** | 100% | |

## Emissions by sector

Figure 2 provides a breakdown of San José's 2019 community-wide emissions by sector and Figure 3 provides a more detailed breakdown of San José's 2019 community-wide emissions, by sector and subsector. The largest source of GHG emissions in San José in 2019 was transportation, followed by energy use in buildings. Together, these two sectors made up 85 percent of San José GHG emissions in 2019.

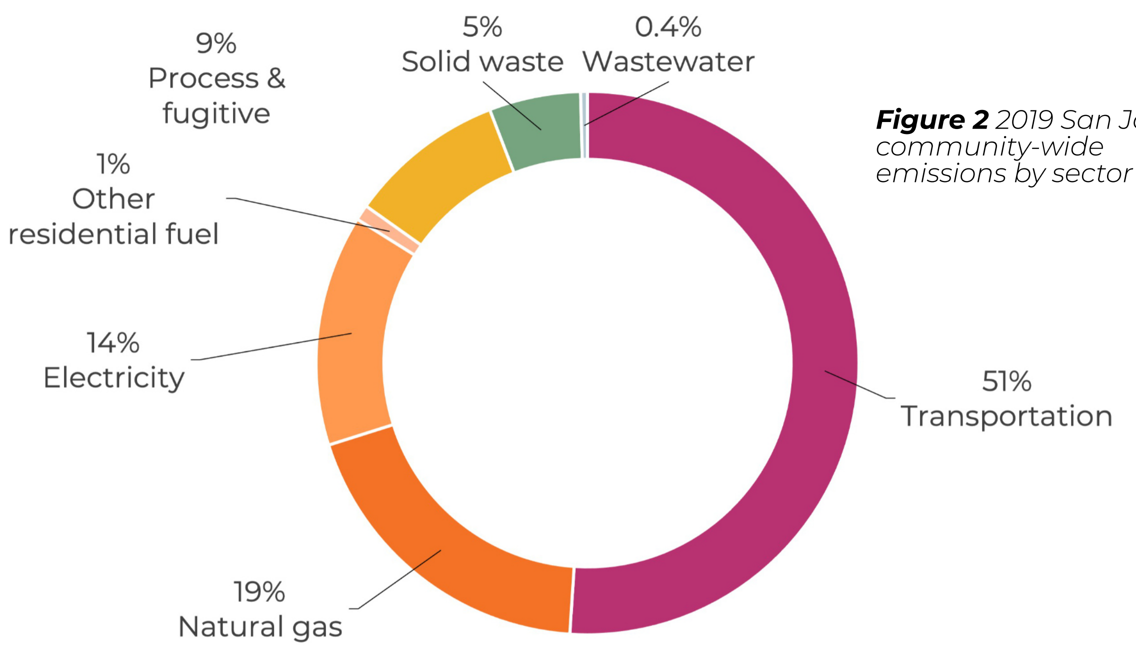
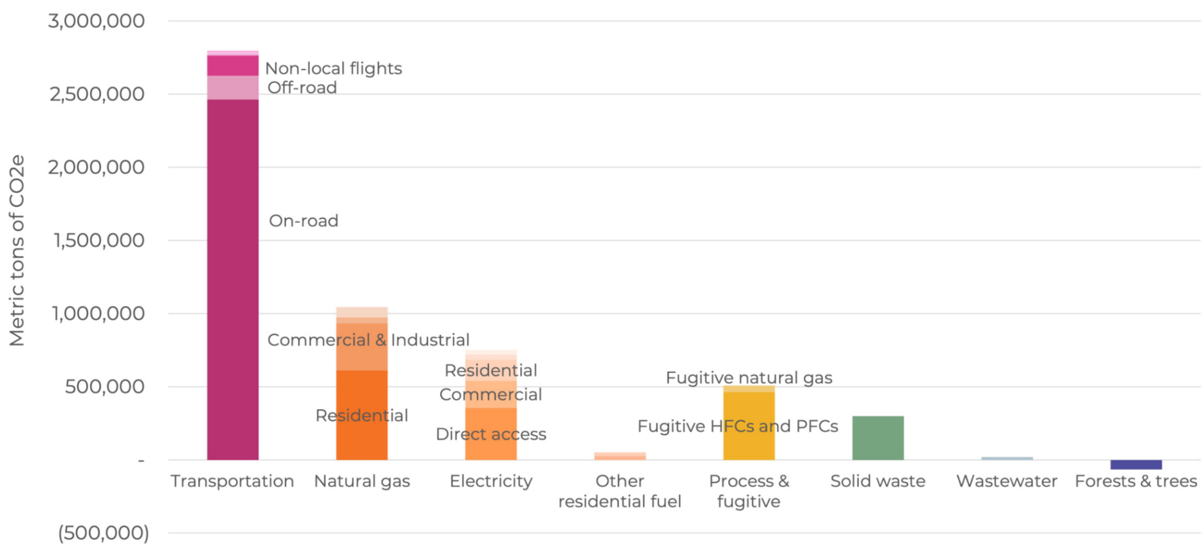



***Figure 2*** *2019 San José community-wide emissions by sector*

***Figure 3*** *2019 San José community-wide emissions by sector and subsector*



The remainder of this section discusses emissions from each sector in further detail and describes changes in the emissions from each sector over time.

## Transportation

As in previous years, transportation was the largest source of San José community emissions in 2019. Figure 4 provides a breakdown of transportation emissions for 2019 and Figure 5 provides a breakdown for all inventory years.

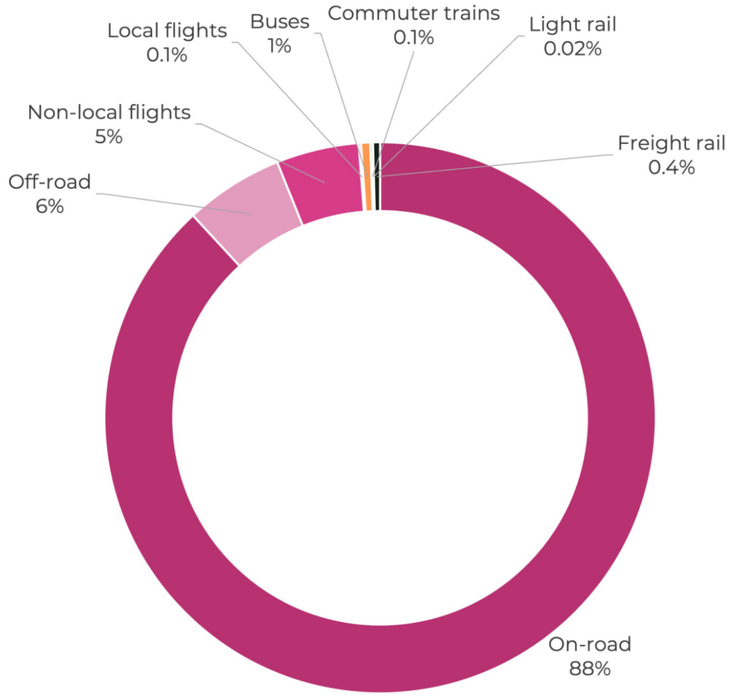
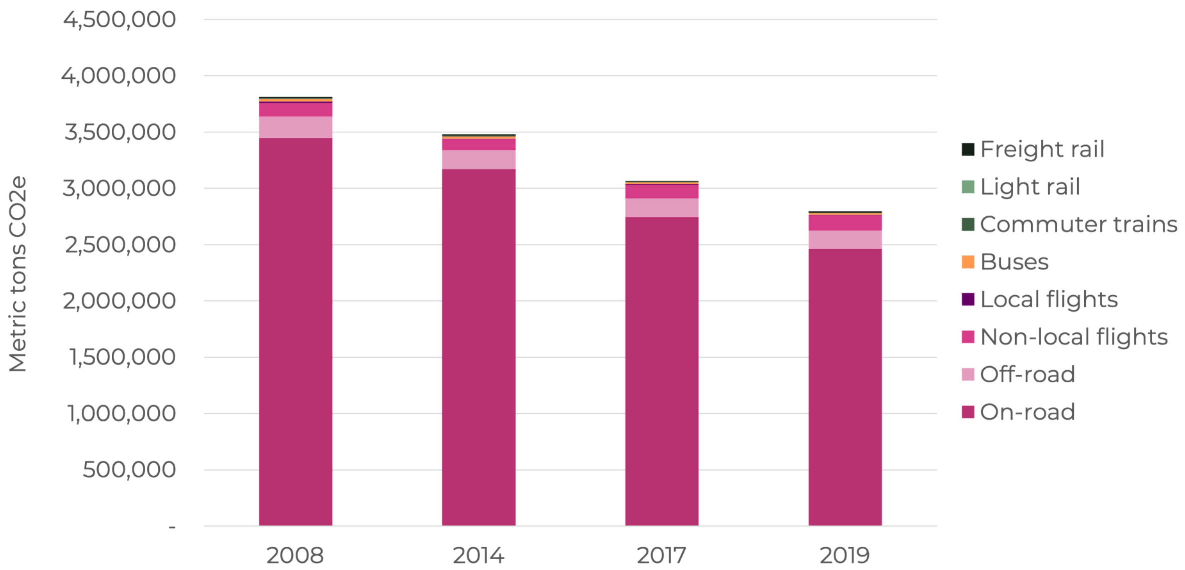


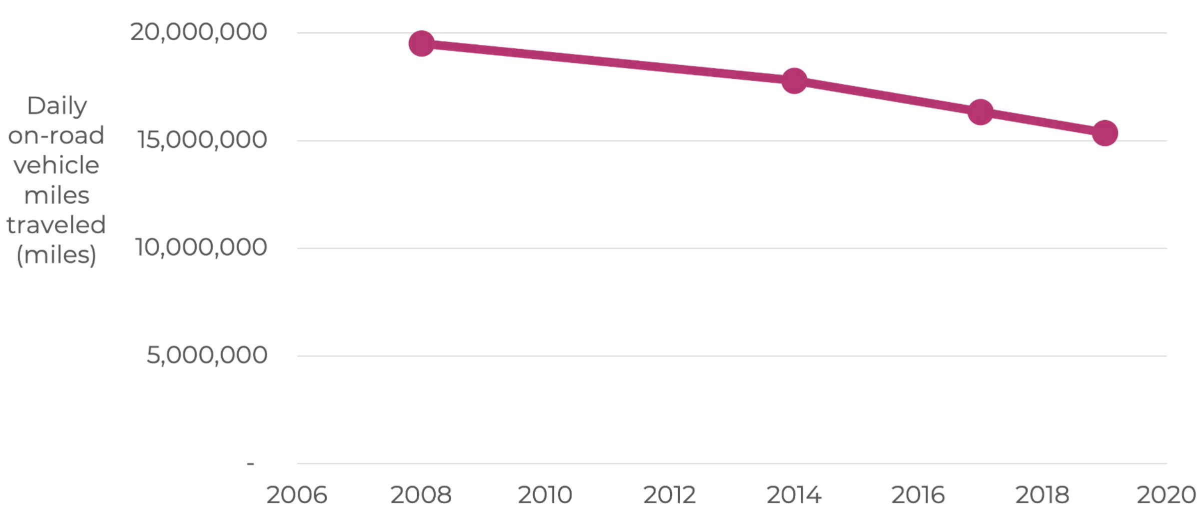

***Figure 4*** *Transportation emissions breakdown for 2019*

***Figure 5*** *Transportation emissions breakdown for all inventory years*



On-road transportation (commercial and private vehicles driving in San José) was the largest source of transportation emissions in 2019. However, according to the best data currently available, on-road transportation emissions have decreased steadily since 2008. This is both because the total amount of driving (measured by vehicle miles traveled, or VMT) has decreased, and because the average vehicle on the road has become newer, more fuel efficient, and cleaner. Figure 6 shows total daily VMT attributable to San José for all inventory years. Note that the 2017 and 2019 VMT estimates are based on a different data source (Google EIE) than the 2008 and 2014 estimates (the City's travel demand forecasting model). This change in data sources may be responsible for some of the apparent decrease in on-road transportation emissions.

***Figure 6*** *Daily VMT attributable to San José for all inventory years*




This inventory report is the first for San Jose to include non-local flights – flights that take off in San José and land in another airport, and flights that take off in another airport and land in San José[10]. It is optional for cities to include these emissions in GHG inventories but recommended if city governments have any influence over flight emissions. The federal government has regulatory oversight of air travel, and despite owning and operating SJC, the City of San José has no authority to regulate the number of flights, aircraft or engine type, or emissions associated with aircraft operating

[10] Emissions from non-local flights are considered Scope 3 emissions in this inventory. The Airport only has control of emissions sources that it owns and operates, all of which are included in Scopes 1 and 2. For this reason, the Airport only tracks Scope 1 and 2 emissions and does not include flight emissions in its sustainability reporting or GHG inventories.

out of SJC or to impose any requirements on airlines operating at SJC. The City also has no authority over the other local airport, Reid-Hillview County Airport. However, the City has taken steps where possible towards reducing aircraft emissions at SJC, including equipping gates with "preconditioned air" and ground power that enable airlines to reduce their use of fuel while parked at the gate and requiring single-engine taxiing. In addition, SJC is pursuing Airport Carbon Accreditation through Airports Council International and has taken many steps to reduce GHG emissions, including switching to electric airport ground support equipment, switching to an all-electric bus fleet (completed in 2019), and installing a 3.4 acre solar array on top of the rental car parking garage.

The other transportation subsectors (off-road vehicles and equipment, local flights, public transit, freight rail, and commuter rail) are small sources of emissions. In particular, commuter trains (Caltrain, Altamont Corridor Express (ACE), and Capitol Corridor) and public transit (VTA light rail, buses, and paratransit) make up less than 1 percent of total community-wide emissions all together, despite transporting thousands of people per day.

EVs and transportation by modes other than single-passenger vehicles are already significantly reducing GHG emissions – by more than 230,000 MT $CO_2e$ in 2019. This means that without these modes of transportation, San José transportation emissions would have been 8% greater. Table 5 provides estimates of emissions avoided by each of these modes of transportation.

***Table 5*** *Emissions avoided by EVs and transportation by modes other than single-passenger vehicles in 2019*

| Transportation mode | Estimated VMT in 2019 | Avoided GHG emissions (MT CO2e) |
|---|---|---|
| EVs | 166,832,099 | 65,138 |
| Commutes by carpool | 149,888,490 | 61,604 |
| Commutes by public transit | 124,075,852 | 50,995 |
| Walking | 56,872,851 | 40,726 |
| Biking (not including bikeshare) | 22,342,407 | 15,999 |
| Scooters | 3,558,394 | 1,463 |
| Commutes by vanpool | 1,316,930 | 541 |
| Bikeshare | 1,222,324 | 502 |
| **Total** | **526,109,348** | **236,969** |

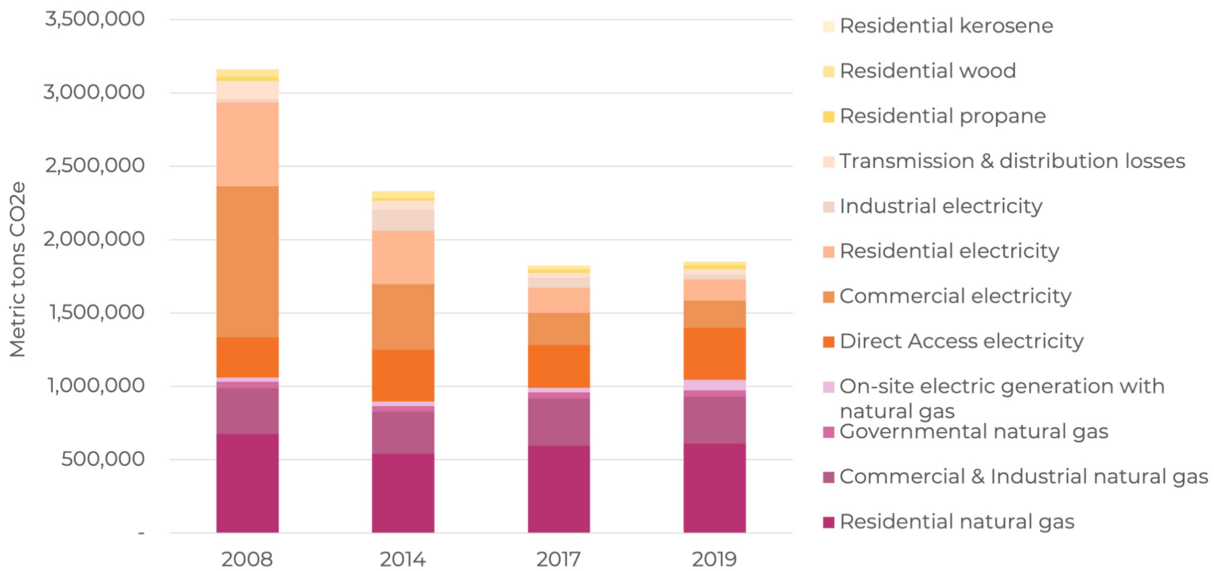
## Buildings

Buildings were the second largest source of San José community emissions in 2019, as in previous inventory years. Table 6 provides a breakdown of buildings emissions by fuel and building/source type. Figure 7 provides a full breakdown of buildings emissions for all inventory years.

***Table 6*** *2019 San José buildings emissions by fuel and building/source type*

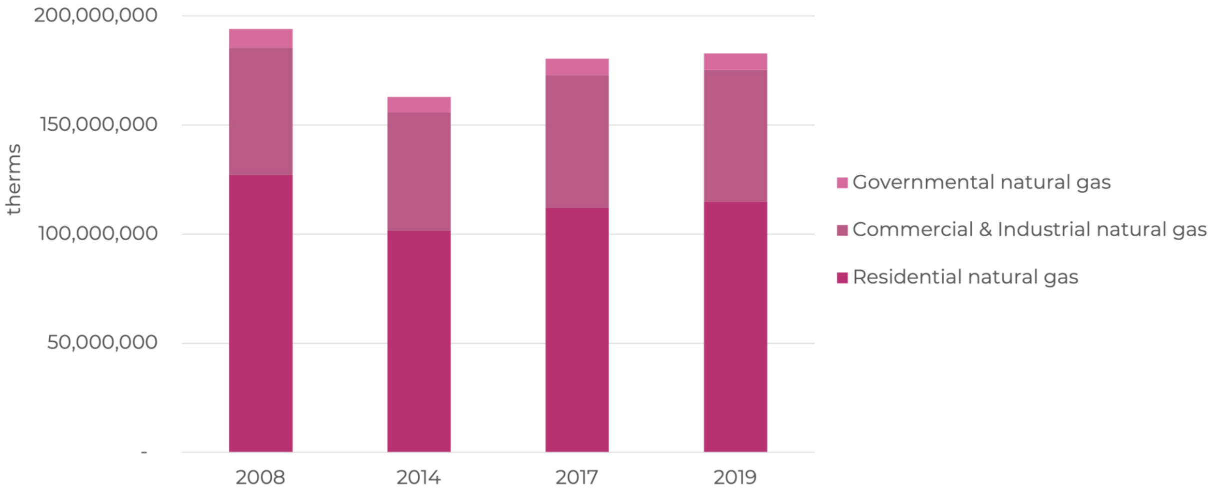
| Fuel type/subsector | Emissions (MT $CO_2$e) | Percent of total buildings emissions |
|---|---|---|
| Natural gas | 1,045,209 | 56% |
| *Residential* | *611,106* | *33%* |
| *Commercial + Industrial* | *321,438* | *17%* |
| *Governmental* | *40,556* | *2%* |
| *On-site electric generation* | *72,110* | *4%* |
| Electricity | 753,963 | 41% |
| *Residential* | *143,338* | *8%* |
| *Commercial* | *185,682* | *10%* |
| *Industrial* | *34,512* | *2%* |
| *Direct Access* | *355,899* | *19%* |
| *Transmission & distribution losses* | *34,533* | *2%* |
| Wood (residential) | 24,714 | 1% |
| Kerosene and other distillate fuels (residential) | 503 | 0.03% |
| Liquid propane gas (residential) | 25,841 | 1% |
| **Total** | **1,850,231** | **100%** |

***Figure 7*** *San José buildings emissions by fuel and building/source type for all inventory years*



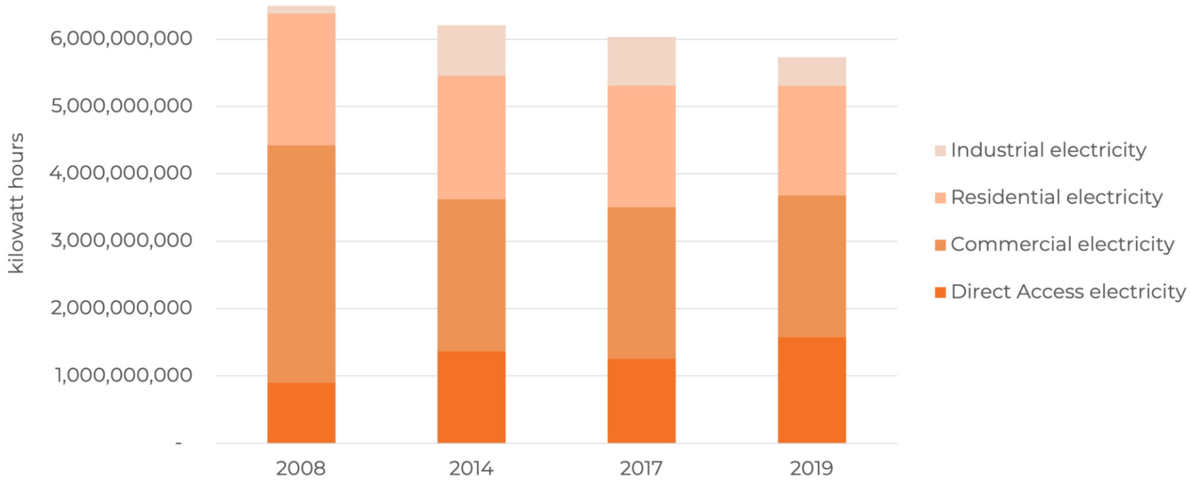
Natural gas was by far the largest source of building emissions in 2019. This is partly because electricity in San José has been getting cleaner (less GHG emissions per kilowatt hour (kWh)) over time, and thus becoming a smaller source of emissions. However, it is also because natural gas use in San José has been increasing since 2014, after a decrease from 2008 to 2014. From 2014 to 2017, most of the increase in natural gas use was in commercial & industrial buildings, but from 2017 to 2019, most of the increase was in residential buildings. In addition, natural gas emissions from on-site generation increased significantly from 2017 to 2019 due to natural gas fuel cells being brought online at two data centers in San José. Figure 8 provides an overview of natural gas use for all inventory years (excluding natural gas use for on-site generation, as we only have data on total emissions from these facilities, not natural gas use).

***Figure 8*** *Natural gas use for all inventory years. Natural gas use for electricity generation (e.g. in cogeneration engines or fuel cells) is not included.*




Electricity use is also a significant source of emissions, but electricity emissions have been decreasing over time as building and appliance efficiency has increased, electricity use has decreased, and the electricity supplied to San José customers has gotten cleaner. However, since the creation of SJCE in 2018, there has been a decrease in electricity usage by industrial customers and an increase in electricity usage by direct access customers, suggesting that some industrial customers have switched to direct access electricity. Direct access electricity customers purchase electricity directly from non-utility Electricity Service Providers, which are likely to be supplying customers with dirtier electricity than PG&E or SJCE. Figure 9 provides an overview of electricity use for all inventory years.

***Figure 9*** *Electricity use for all inventory years*




Still, the cleaner electricity mix provided by SJCE reduces San José electricity emissions. If all electricity in San José had been supplied by PG&E, electricity emissions in 2019 would have been greater by 30,551 MT $CO_2$e.

Other residential fuels (wood, kerosene/distillate fuels, liquid propane gas) are a consistently small source of building emissions.

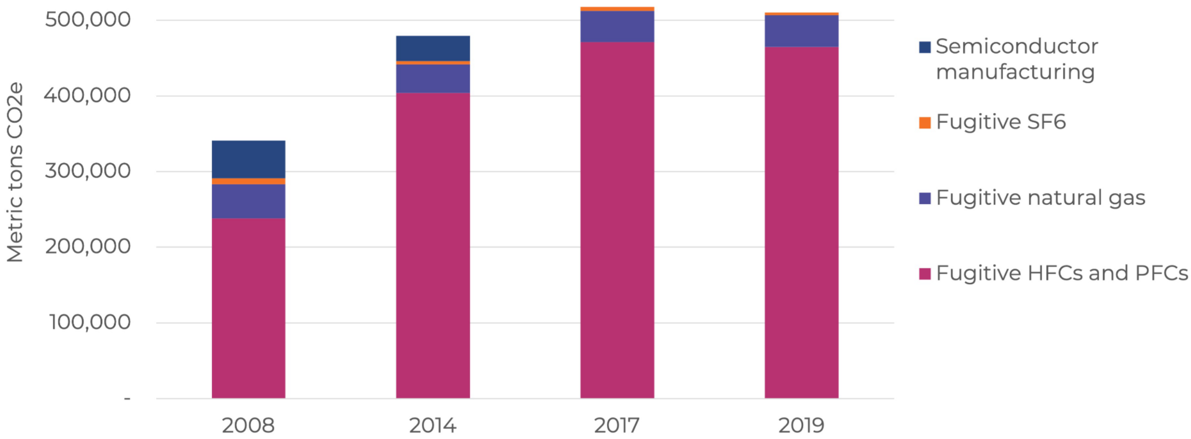
## Process and fugitive emissions

Industrial processes and leaks (fugitive emissions) of HFCs, PFCs, natural gas, and $SF_6$ have consistently been significant sources of GHG emissions in San José. Emissions from this sector increased 52 percent from 2008 to 2017 and then decreased 1 percent from 2017 to 2019. Table 7 provides a breakdown of emissions from this sector for 2019, and Figure 10 compares process and fugitive emissions over all inventory years.

***Table 7*** *2019 industrial process and fugitive emissions in San José*

| Emission type | Emissions (MT $CO_2$e) | Percent of total sector emissions |
|---|---|---|
| Fugitive HFCs and PFCs | 464,753 | 91% |
| *Commercial* | *220,081* | *43%* |
| *Residential* | *94,955* | *19%* |
| *Industrial* | *79,804* | *16%* |
| *Transportation* | *69,912* | *14%* |
| Fugitive natural gas | 42,088 | 8% |
| Fugitive $SF_6$ | 3,738 | 1% |
| Industrial process emissions | 0 | 0% |
| **Total** | **510,579** | **100%** |

***Figure 10*** *San José industrial process and fugitive emissions for all inventory years*




In 2019, there were no reported sources of industrial process emissions in San José. In 2008 and 2014, three companies reported emissions of high-GWP gases from semiconductor manufacturing to the U.S. EPA, but all three companies closed their San José manufacturing facilities between 2014 and 2017.

Fugitive (leaked) HFCs and PFCs make up the majority of the emissions from this sector. These high-GWP gases were adopted internationally as replacements for ozone-depleting substances such as chlorofluorocarbons (CFCs), and hydrochlorofluorocarbons (HCFCs). HFCs and PFCs are frequently used in refrigeration and air-conditioning equipment, and can leak during equipment use or during equipment disposal. Emissions from this subsector increased from 2008 to 2017 and then decreased slightly from 2017 to 2019. Emissions estimates for this subsector are scaled down from statewide estimates, and so more research would be needed to confirm if emissions from this subsector truly decreased in San José, and if so, why.

Fugitive (leaked) natural gas is released from natural gas pipes and distribution lines. Emissions from this subsector are assumed to scale with total natural gas use, so they decreased from 2008 to 2014 and then increased steadily from 2014 to 2019, as natural gas use did.

Fugitive (leaked) $SF_6$ is released from electricity transmission and distribution equipment such as circuit breakers and switchgears, where it is used as an insulator. Emissions from this subsector have varied over time, but 2019 emissions are lower than in any previous year. Emissions estimates for this subsector are also scaled down from statewide estimates, and so more research would be needed to confirm if emissions from this subsector truly decreased in San José. However, a decrease would make sense given that

PG&E, which operates the electricity infrastructure in San José, is working to decrease $SF_6$ leakage.[11]

## Solid waste

Solid waste is another important source of community-wide emissions in San José. The most prominent source of GHG emissions from solid waste is fugitive methane released by the decomposition of organic waste over time in the anaerobic conditions of a landfill. The City of San José has made great progress over the last years in diverting residential, commercial, and municipal organic waste from landfills. This has led to a decrease in solid waste emissions from these sectors over time, because both anaerobic digestion and composting of organic waste produce significantly less GHG emissions than landfilling. Emissions from construction & demolition and other waste (mostly waste taken directly to landfill by individuals) are only a rough estimate due to lack of good data, but seem to vary over time, perhaps with changes in the amount of construction in the city. Most organic waste produced in San José in 2019 was processed at the ZeroWaste Energy Development (ZWED) anaerobic digestion facility in San José, composted at the Z-Best Composting Facility (Z-Best) in Gilroy, or recycled. This diversion of waste from landfill prevented about 298,092 MT $CO_2$e of emissions. Table 8 shows solid waste emissions by subsector and disposal type for 2019 and Figure 11 shows solid waste emissions by sector and disposal type for all inventory years. Table 9 and Figure 12 show the emissions avoided by each alternative to landfilling.

***Table 8*** *2019 San José solid waste emissions and quantity by subsector and disposal type*

| Subsector | Quantity (short tons) | Emissions (MT CO2e) | Percent of total sector emissions |
|---|---|---|---|
| Residential - landfill | 120,425 | 70,012 | 23% |
| Residential - recycling | 101,885 | Not estimated | |
| Residential – composting | 281,147 | 16,759 | 6% |
| Commercial - landfill | 83,829 | 55,175 | 18% |
| Commercial - recycling | 125,698 | Not estimated | |
| Commercial – composting | 29,455 | 1,635 | 1% |
| Commercial – anaerobic digestion | 38,388 | 3,773 | 1% |
| C&D/other - landfill | 401,840 | 151,008 | 51% |
| C&D/other - recycling | 264,219 | Not estimated | |
| C&D/other - composting | 5,322 | 371 | 0.1% |
| **Total** | **1,417,430** | **298,733** | **100%** |

[11] https://www.pgecorp.com/corp_responsibility/reports/2019/en02_climate_change.html

*Figure 11* Solid waste emissions by sector and disposal type for all inventory years

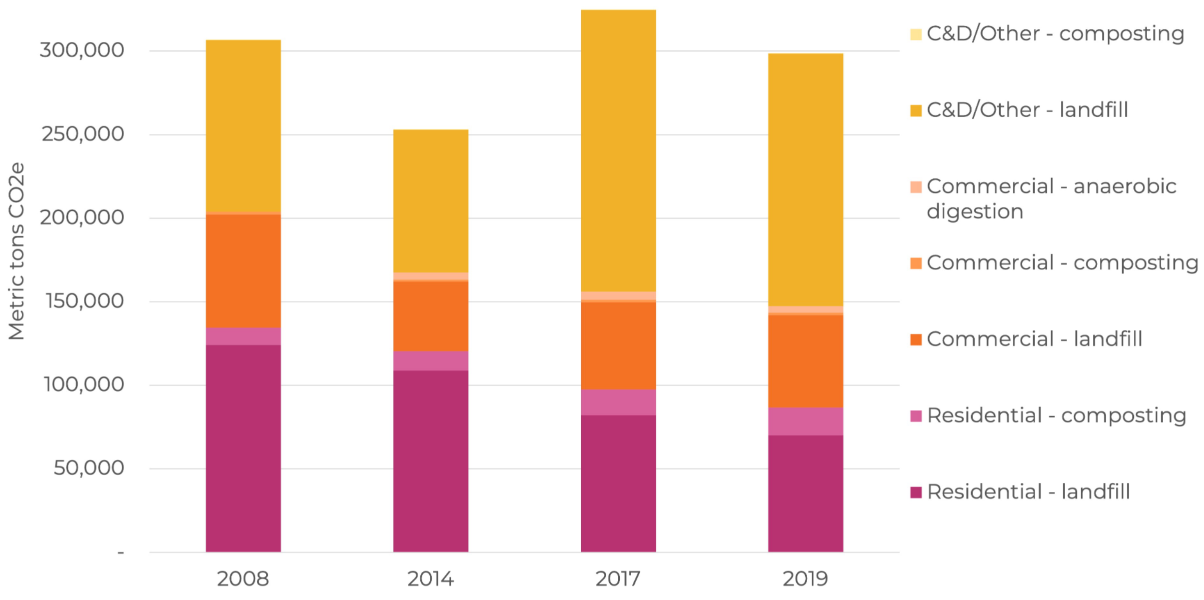
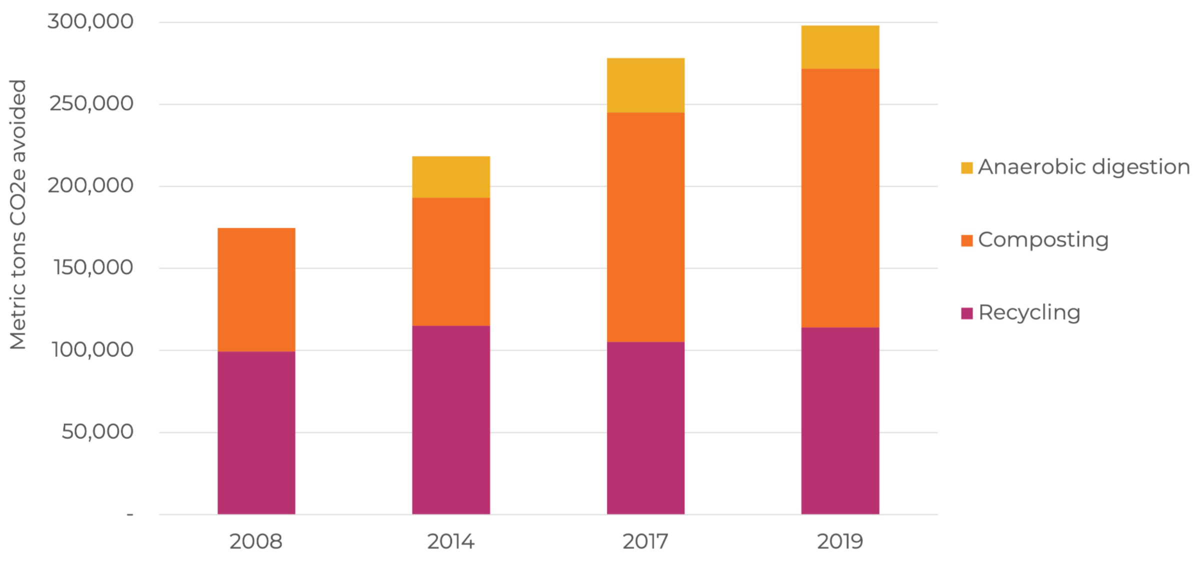



*Table 9* Emissions avoided by diversion of organic waste from landfills in 2019

| Disposal method | Avoided emissions (MT CO2e) |
|---|---|
| Composting | 157,738 |
| Recycling | 114,000 |
| Anaerobic digestion | 26,355 |
| **Total** | **298,092** |

*Figure 12* Emissions avoided by recycling, composting, and anaerobic digestion of solid waste instead of landfilling, for all inventory years



Only the $CH_4$ and $N_2O$ generated by composting and anaerobic digestion of organic waste are counted in this inventory. The $CO_2$ produced when organic waste is composted or anaerobically digested is classified as biogenic and excluded from GHG inventories. This is because $CO_2$ released from organic waste, which is derived from plants or animals, is carbon that was recently pulled from the atmosphere by plants. This is unlike the ancient carbon that is added to the atmosphere when fossil fuels are burned.

## Wastewater treatment

Wastewater treatment was a small source of San José community-wide emissions in 2019, as in previous years[12]. Wastewater treatment uses energy in the form of electricity and combustion fuel. In addition, as wastewater is collected, treated, and discharged, chemical and biological processes in aerobic and anaerobic conditions lead to the creation and emission of nitrous oxide. Table 10 shows 2019 wastewater treatment energy use emissions by fuel type and wastewater process emissions broken down by process within the treatment plant.

***Table 10*** *2019 San José wastewater treatment emissions by subsector*

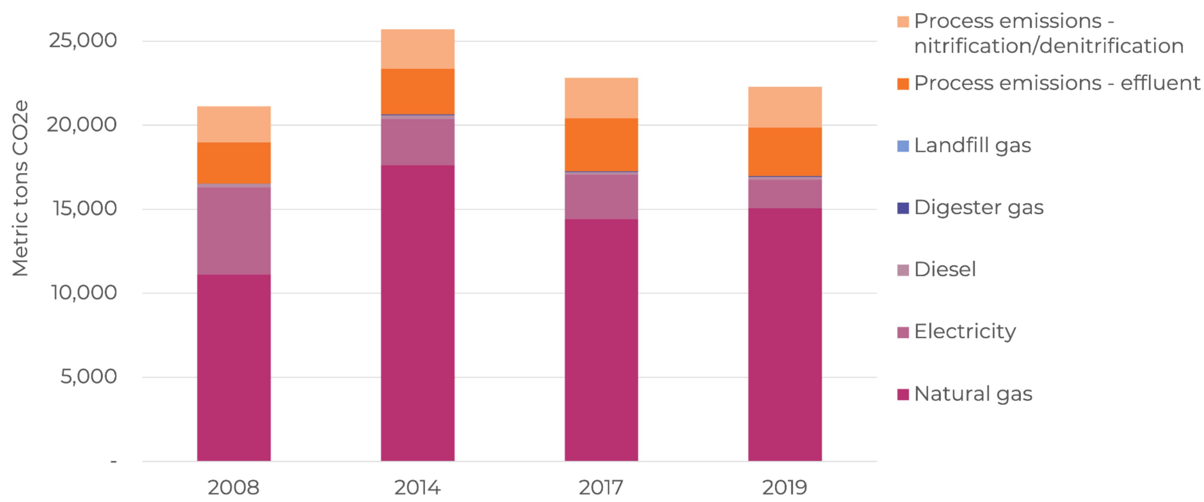
| Subsector | Emissions (MT CO2e) | Percent of total sector emissions |
|---|---|---|
| Energy use | 16,979 | 76% |
| *Natural gas* | *15,070* | *68%* |
| *Electricity* | *1,695* | *8%* |
| *Diesel* | *153* | *1%* |
| *Digester gas* | *62* | *0.3%* |
| Process emissions | 5,306 | 24% |
| *Treated effluent discharge* | *2,876* | *13%* |
| *Nitrification/ denitrification* | *2,430* | *11%* |
| **Total** | **22,285** | **100%** |

[12] Note that the GHG emissions reported for wastewater treatment in this inventory are lower than the wastewater treatment emissions reported in the 2018 city government operations inventory. This is because the city government operations inventory included all emissions associated with wastewater treatment at the Wastewater Facility, because the City of San José has complete operational control over the facility. In contrast, this inventory includes only the emissions associated with treatment of wastewater from San José sources. Because the Wastewater Facility also treats wastewater from other nearby cities and districts, only a fraction of total emissions from the Wastewater Facility are reported here. See the Appendix for more details.

The emissions from digester gas combustion were low because it is a biogas, and the $CO_2$ produced when biogases are burned is classified as biogenic and excluded from GHG inventories. Only the $CH_4$ and $N_2O$ produced when biogases are burned are included.

Emissions from wastewater treatment increased between 2008 and 2014 because the San José-Santa Clara Regional Wastewater Facility (Wastewater Facility), which treats San José's wastewater, stopped using landfill gas in 2012. As a result, the Wastewater Facility increased its usage of natural gas and electricity, both of which generate more emissions than landfill gas. The energy mix powering the Wastewater Facility has remained stable since then, as have wastewater treatment emissions. Figure 13 shows wastewater treatment emissions by subsector for all inventory years.

***Figure 13*** *Wastewater treatment emissions by subsector for all inventory years*




Wastewater Facility energy use emissions are expected to decrease in future as a result of two projects in the Capital Improvement Program currently underway at the Wastewater Facility. First, a new Cogeneration Facility was completed in December 2020 that uses digester gas more efficiently than the previous cogeneration engines, so that the same amount of digester gas can generate more power. Second, the digester rehabilitation project should increase the amount of digester gas produced and available for consumption at the Wastewater Facility. Both these projects should reduce the Wastewater Facility's needs for natural gas and electricity from the grid. In addition, the Wastewater Facility may begin to use landfill gas from Newby Island Landfill again in coming years, which would also decrease emissions.

## Forests and urban trees

Forests and trees remove carbon dioxide from the atmosphere through photosynthesis and sequester the carbon in wood. Although forests and trees can also emit carbon dioxide, for instance when burned, they are currently a net carbon sink in San José and are counted in this inventory as negative emissions. This carbon sink is small compared to total community-wide emissions in San José, but could become more important as community-wide emissions decrease and the urban tree canopy increases over time.

Carbon sequestration was calculated separately for forests and for urban trees in San José. Forests make up about 6 percent of the land area of San José, and are quite stable – from 2006 to 2016 (the period for which data are available on land cover in San José), only 28 hectares lost forest cover and 7 hectares became newly forested, while 2,639 hectares of forest stayed forested. Urban tree canopy covers about 13 percent of the land area of San José, and has been decreasing slowly over time – from 2012 to 2018 (the two years for which data are available), the city lost about 699 hectares of tree cover. As a result, sequestration by forests and trees in San José has decreased slightly over time. Figure 14 provides a map of forests and urban tree canopy in San José and Figure 15 shows forest and urban tree emissions and sequestration over all inventory years.

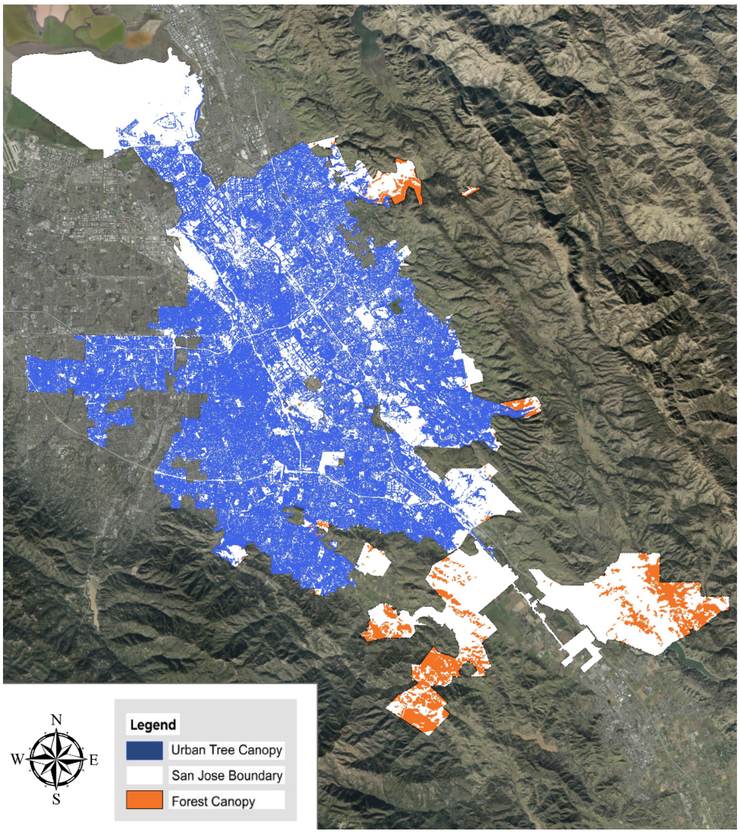



***Figure 14*** *Forests and urban tree canopy in San José. The most recent data available are shown – 2016 data on forest extent and 2018 data on urban tree canopy.*

***Figure 15*** *Forest and tree emissions and sequestration over all inventory years*

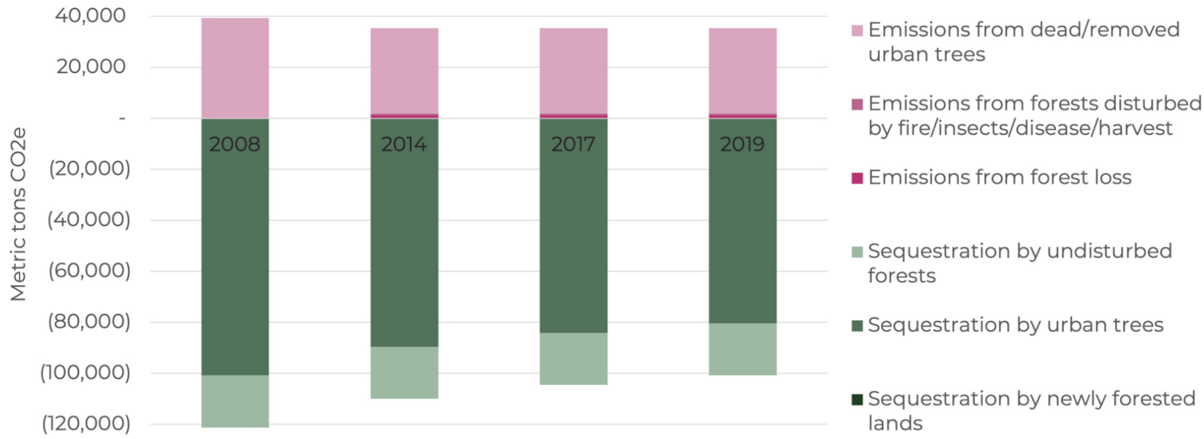



Table 11 provides an estimate of the emissions and sequestration from forests and trees in San José in 2019. Note that this estimate accounts for $CO_2$ released when forests are disturbed or cut down, and for $CO_2$ released when urban trees die or are cut down.

***Table 11*** *2019 emissions and sequestration by San José forests and urban trees*

| Subsector | Emissions or sequestration (MT CO2e) |
|---|---|
| Sequestration by urban trees | -80,478 |
| Sequestration by undisturbed forests | -20,323 |
| Sequestration by newly forested lands | -6 |
| Emissions from dead/removed urban trees | 33,449 |
| Emissions from forest loss | 1,268 |
| Emissions from forests disturbed by fire/insects/disease/harvest/other | 625 |
| **Total** | **-65,465** |

## Emissions sectors not included in the inventory total

Some emissions sectors provide useful information but should not be included in the inventory total because it would result in double-counting of emissions that are already included in other sectors. The CRF protocol requires inventories to include emissions from electricity generated and supplied to the grid within the city boundary, and the USCP requires inventories to include emissions from the production, treatment, and distribution of water used within the city boundary. Emissions from grid-supplied electricity generated within the city are accounted for elsewhere in this inventory by the emissions factors used to calculate emissions from electricity use, if the electricity generated within the city is purchased by PG&E or SJCE for supply to San José customers. Emissions from water production, treatment, and distribution come from energy use both within and outside of San José. The water-related emissions from energy use within San José are included in the buildings sector. Summaries of emissions from these two sectors are included here for informational purposes, but these sectors are not included in the inventory total.

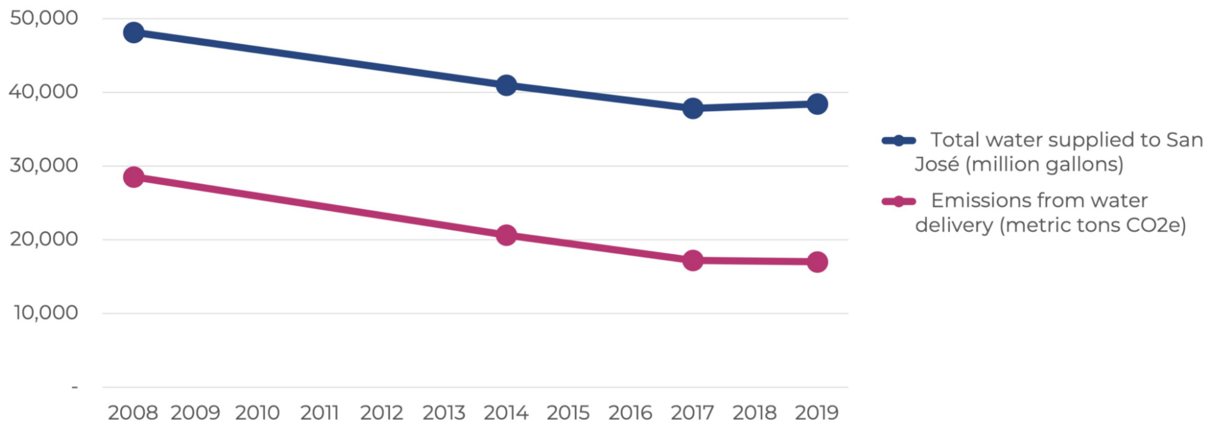
## Water delivery

Water customers in San José are served by the City of San José (San José Municipal Water System) and two water companies, San Jose Water Company and Great Oaks Water Company. Total water supplied to San José decreased from 2008 to 2017, and then increased slightly from 2017 to 2019. Emissions from water delivery remained flat from 2017 to 2019, however, because the California electric grid became cleaner. Water supplied in San José in 2019 and associated emissions are detailed in Table 12. Figure 16 shows changes in the amount of water supplied to San José and water delivery emissions over time. Note that water supplied to San José is reported rather than water consumption by customers, because this better captures the amount of water treatment & distribution that San José is responsible for. Water supplied equals water consumption by customers plus water lost to distribution system leaks and mains breaks plus water used for firefighting. In addition, before 2016, water retailers were only required to report water consumption data every five years, while water supply (production) data were reported annually.

***Table 12*** *2019 water supplied and water delivery emissions in San José by supplier*

| Water supplier | Million gallons of water supplied | Emissions (MT CO2e) | Percent of total water delivery emissions |
|---|---|---|---|
| San Jose Water Company | 29,549 | 12,915 | 76% |
| San José Municipal Water System | 5,497 | 1,444 | 8% |
| Great Oaks Water Company | 3,386 | 2,644 | 16% |
| **Total** | **38,433** | **17,003** | **100%** |

***Figure 16*** *Water supplied to San José and water delivery emissions for all inventory years*



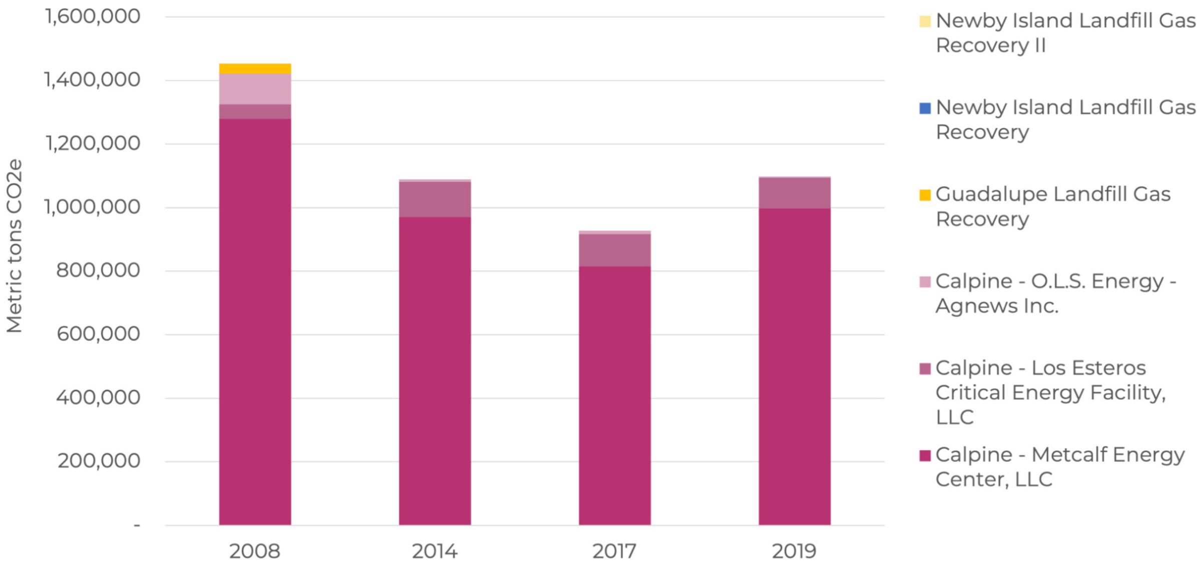

## Electricity generated for supply to the electric grid

There are three natural gas power plants within San José that supply electricity to the grid. In addition, in past years two landfills within San José used landfill gas to generate electricity for supply to the electric grid. These facilities are listed in Table 13 with their identification numbers under the CARB Mandatory Greenhouse Gas Reporting Regulation and GHG emissions from electricity generation in 2019. Emissions from electricity generation decreased between 2008 and 2014, due to the end of electricity generation at Guadalupe Landfill. Emissions from electricity generation remained about flat from 2014 to 2019. Figure 17 shows emissions from the electricity generation sector for all inventory years.

***Table 13*** *Electricity generating facilities in San José, with 2019 GHG emissions from electricity generation for supply to the grid*

| Electricity generating facility | CARB Mandatory Greenhouse Gas Reporting facility number | Emissions (MT $CO_2e$) |
|---|---|---|
| Calpine - Metcalf Energy Center, LLC | 100343 | 996,791 |
| Calpine - Los Esteros Critical Energy Facility, LLC | 101143 | 97,548 |
| Calpine - O.L.S. Energy - Agnews Inc. | 101426 | 3,514 |
| Newby Island Landfill Gas Recovery | 101658 | 0 |
| Newby Island Landfill Gas Recovery II | 101023 | 0 |
| Guadalupe Landfill Gas Recovery | 101713 | 0 |
| **Total** | | **1,097,853** |

***Figure 17*** *Emissions from the electricity generation sector for all inventory years*



# Conclusion

This 2019 GHG emissions inventory was completed in order to measure San José's progress in reducing community-wide emissions, using inventories for 2008, 2014, and 2017 as reference points. San José community-wide emissions have steadily decreased over time. Table 14 provides a full breakdown of emissions in all four years.

***Table 14*** *San José community-wide GHG emissions by sector and subsector for all inventory years (continued on next page)*

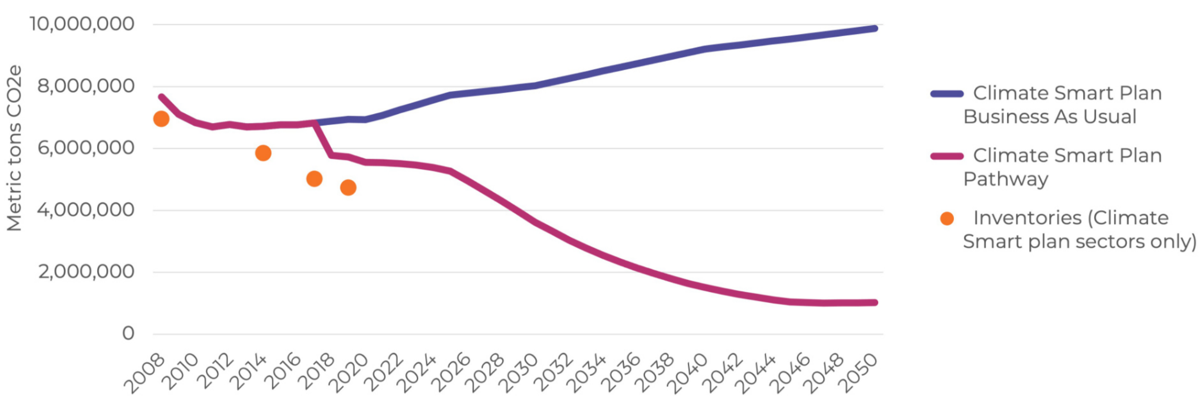
| Emission sector/subsector | 2008 emissions (MT $CO_2$e) | 2014 emissions (MT $CO_2$e) | 2017 emissions (MT $CO_2$e) | 2019 emissions (MT $CO_2$e) | % of total in 2019 |
|---|---|---|---|---|---|
| **Transportation** | **3,813,131** | **3,480,351** | **3,067,766** | **2,795,791** | **51%** |
| *On-road vehicles* | *3,448,462* | *3,170,593* | *2,746,499* | *2,463,769* | *45%* |
| *Off-road vehicles* | *188,682* | *169,416* | *164,279* | *161,865* | *3%* |
| *Aviation – non-local flights* | *122,171* | *96,983* | *121,439* | *135,343* | *2%* |
| *Buses and paratransit* | *20,572* | *17,700* | *17,114* | *15,066* | *0.3%* |
| *Freight rail* | *12,520* | *14,300* | *8,670* | *11,539* | *0.2%* |
| *Commuter rail* | *4,024* | *4,023* | *4,058* | *3,878* | *0.1%* |
| *Aviation – local flights* | *12,756* | *4,861* | *4,562* | *3,810* | *0.1%* |
| *Light rail* | *3,944* | *2,475* | *1,145* | *521* | *0.01%* |
| **Buildings** | **3,161,915** | **2,330,867** | **1,820,938** | **1,850,231** | **34%** |
| *Natural gas* | *1,060,469* | *897,191* | *990,473* | *1,045,209* | *19%* |
| *Electricity* | *2,021,350* | *1,369,775* | *783,123* | *753,963* | *14%* |
| *Other residential fuels* | *80,097* | *63,902* | *47,342* | *51,059* | *1%* |
| **Process and fugitive** | **341,240** | **479,425** | **517,727** | **510,579** | **9%** |
| *Fugitive HFCs and PFCs* | *238,369* | *404,061* | *471,232* | *464,753* | *8%* |
| *Fugitive natural gas* | *44,943* | *37,640* | *41,478* | *42,088* | *1%* |
| *Fugitive $SF_6$* | *7,676* | *4,667* | *5,017* | *3,738* | *0.1%* |
| *Industrial process emissions* | *50,252* | *33,057* | *0* | *0* | *0%* |

***Table 14** continued*

| Emission sector/subsector | 2008 emissions (MT $CO_2e$) | 2014 emissions (MT $CO_2e$) | 2017 emissions (MT $CO_2e$) | 2019 emissions (MT $CO_2e$) | % of total in 2019 |
|---|---|---|---|---|---|
| **Solid waste** | **306,931** | **253,277** | **324,981** | **298,733** | **5%** |
| *C&D/other* | *103,025* | *85,709* | *168,947* | *151,379* | *3%* |
| *Residential* | *134,631* | *120,423* | *97,642* | *86,771* | *2%* |
| *Commercial* | *69,276* | *47,145* | *58,392* | *60,583* | *1%* |
| **Wastewater treatment** | **21,130** | **25,710** | **22,833** | **22,285** | **0.4%** |
| **Total emissions** | **7,644,347** | **6,569,630** | **5,754,245** | **5,477,619** | **100%** |
| **Forests and trees** | **-81,899** | **-74,661** | **-69,144** | **-65,465** | **-1%** |
| **Net emissions** | **7,562,447** | **6,494,969** | **5,685,102** | **5,412,154** | |

When considering only the sectors that are included in the Climate Smart San José plan (highlighted in pink in Table 14), the overall emissions reductions so far exceed Climate Smart goals. Figure 18 compares San José emissions reduction progress so far to the reduction pathway in the Climate Smart plan.

***Figure 18** San José emissions reduction progress compared to the Climate Smart plan pathway*




San José's community-wide GHG emissions have decreased even as the city's population and number of jobs have increased (see Figure 19). As a result, GHG emissions per San José resident have also decreased, and appear on track to reach the Climate Smart 2021 goal of 5 MT $CO_2e$ per person per year (see Figure 20).

***Figure 19*** *Changes in San José community-wide GHG emissions, population, and jobs since 2008*

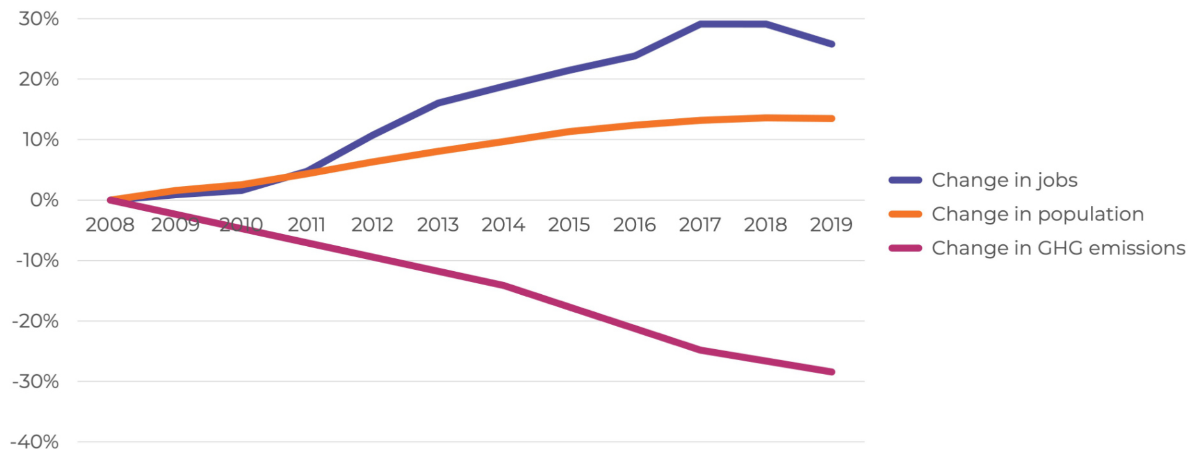
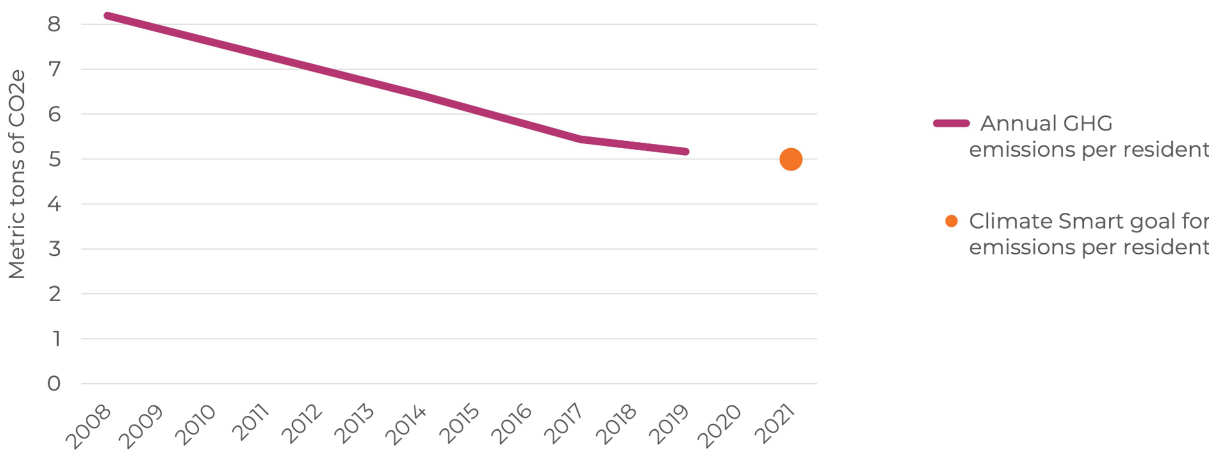



***Figure 20*** *Change in GHG emissions per San José resident over time*

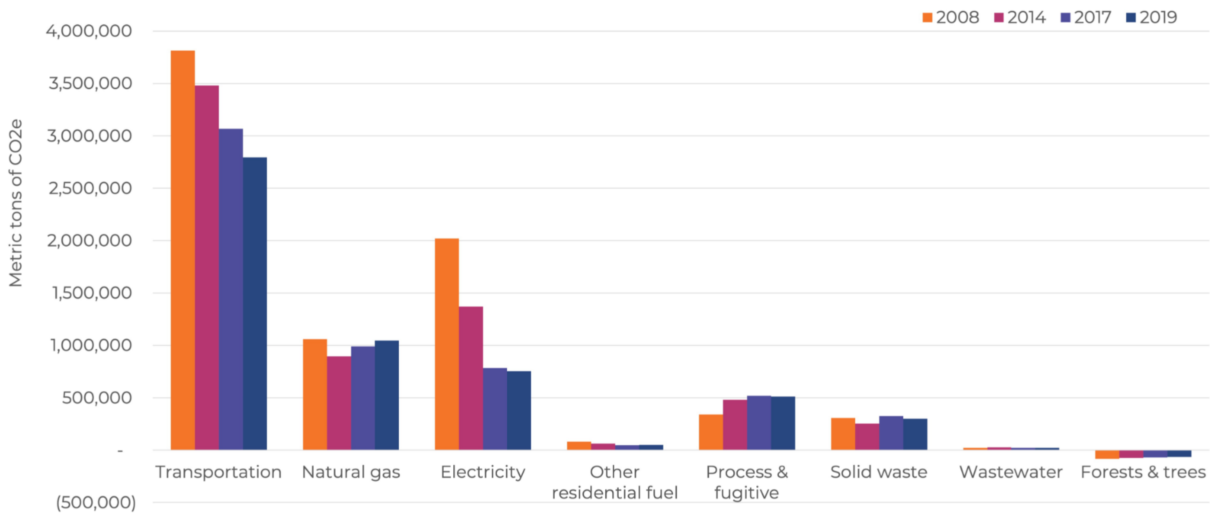



This report uses the production-based approach to city GHG accounting, which totals GHG emissions produced in a city or as the result of activities taking place in a city. Another approach to calculating GHG emissions is the consumption-based approach, which totals GHG emissions produced anywhere in order to create goods or services that are purchased (consumed) in a city. A 2014 research study[13] estimated San José's consumption based GHG emissions at 15,830,739 MT $CO_2e$ – more than twice as much as 2014 production-based emissions. This larger number indicates further opportunities for San José residents and businesses to help reduce global GHG emissions - by reducing consumption of new goods and by choosing to purchase and use food, clothing, and other goods that are less carbon-intensive and transported shorter distances.

[13] Christopher Jones and Daniel M. Kammen. Spatial Distribution of U.S. Household Carbon Footprints Reveals Suburbanization Undermines Greenhouse Gas Benefits of Urban Population Density. Environmental Science & Technology 2014 48 (2), 895-902. DOI: 10.1021/es4034364

Figure 21 shows how emissions from each sector have changed over time. Transportation, electricity, and solid waste emissions are all headed in the right direction, but could do so more rapidly. Process and fugitive emissions may be leveling off. Emissions from natural gas use in buildings, in contrast, have been increasing. The City of San José has already taken several important steps to reduce major sources of community-wide emissions, including establishing SJCE, adopting a Reach Code and Natural Gas Prohibition Ordinance, and developing programs to support electric vehicle adoption and transportation mode shift. This inventory shows the impacts of those actions, but also shows that more work remains. In particular, it supports a continued focus on existing building electrification, vehicle electrification, and transportation mode shift.

***Figure 21*** *Comparison of community-wide GHG emissions from each sector over all inventory years*




Through these efforts and others, the City of San José can achieve both emissions reductions and additional accompanying benefits, such as improving resident safety, health, economic stability, and quality of life.

# Appendix

## Detailed Methods

### Transportation

**On-road vehicles.** Activity data for 2008 and 2014 came from the City's travel demand forecasting model, which is a refinement of the C/CAG VTA Bi-County transportation model that provides more analytical detail and a higher level of accuracy for simulated travel in San José. The City's travel demand forecasting model represents all motorized modes of travel used within the Bay Area, including both private and commercial traffic and Caltrain, Bay Area Rapid Transit (BART), ACE, and all of VTA's bus routes and light rail lines. The City's travel demand forecasting model has been validated with 2008 and 2015 data on county to county travel flows, a.m. and p.m. peak traffic counts, average daily traffic on the highway network, and transit ridership. Activity data for 2014 were estimated by interpolating linearly between 2008 and 2015 values.

Because the City's travel demand forecasting model has not been validated with real-world data since 2015, activity data for 2019 were taken from Google EIE (https://insights.sustainability.google/), which has estimates for 2018 and 2019 based on mobile phone location data.

The City's travel demand forecasting model provides estimates of weekday daily VMT per speed bin (0-5 miles per hour (mph), 5.001-10 mph, etc). These estimates include 100% of in-boundary trip lengths and 50% of inbound and outbound trip lengths. These weekday daily VMT estimates were multiplied by emission factors from the CARB EMFAC 2017 model v1.0.3 to estimate weekday daily emissions. The EMFAC model provides emission factors for each vehicle type, for each speed bin, for each county. Emission factors for Santa Clara County were used. EMFAC also provides a breakdown of VMT by vehicle type for each speed bin. An average emission factor for each speed bin was estimated by calculating the average of all vehicle type-specific emission factors for that speed bin, weighted by the proportion of VMT generated by each vehicle type. Weekday daily emissions were converted to annual emissions by multiplying them by an annualization factor derived from California Department of Transportation Performance Measurement System (PeMS) data (http://pems.dot.ca.gov/) for San José aggregated by weekday. The annualization factor was calculated with the following formula:

*Annualization factor = 365 x (average daily VMT/average weekday VMT)*

Google EIE provides estimates of annual VMT and annual GHG emissions for in-boundary, inbound, and outbound trips by automobile, bus, train, walking, and biking. The automobile category includes commercial vehicles and trucks and was used to represent on-road vehicle emissions. 2019 emissions were calculated by adding up 100% of EIE in-boundary emissions for the automobile category and 50% of inbound and outbound automobile emissions. 2017 emissions were calculated by linear interpolation between the 2014 total emissions estimate based on the City's travel demand forecasting model and the 2019 total emissions estimate based on Google EIE.

Emissions avoided in 2019 by electric scooters, bikeshare, and commuters traveling by transit, carpool, or vanpool were estimated using the Shared Use Mobility Center (SUMC) benefits calculator (https://learn.sharedusemobilitycenter.org/benefitcalculator/san-jose-ca-usa). These estimates were based on City data on scooters (5 companies with about 1,500 scooters each in 2019) and bikeshare (1,250 shared bikes in 2019); SUMC estimates of numbers of transit commuters (22,450), carpool commuters (58,957), and vanpool commuters (518), and California Energy Commission data on EV registration in the San José Metropolitan Statistical Area (3% of all private vehicles in 2019; https://tableau.cnra.ca.gov/t/CNRA_CEC/views/DMVDataPortal_15986380698710/STOCK_Dashboard). Emissions avoided in 2019 by walking and biking were estimated using VMT data for these modes for San José from Google EIE, and EMFAC 2017 emissions factors for the 20-25 miles per hour speed bin. The estimate of bikeshare VMT from the SUMC benefits calculator was subtracted from the Google EIE biking VMT estimate before calculating avoided emissions to avoid double counting.

**Aviation (local and non-local).** Aviation emissions from RHV were estimated using the fuel sales approach, in which emissions are calculated based on the amount of fuel sold at an airport, because the data needed were easily available and there was insufficient capacity to do a more in-depth assessment of RHV aviation emissions. Emissions estimates for RHV local and non-local flights were calculated using activity data from the Federal Aviation Administration's Air Traffic Activity System (FAA ATADS; https://aspm.faa.gov/opsnet/sys/Airport.asp) and annual fuel sales data downloaded from the RHV website. 2018 and 2019 fuel sales data were not available for RHV at the time of inventory preparation, so 2017 fuel sales were used as a proxy for 2019 fuel sales. The percent of fuel used in local or non-local flights was estimated by multiplying total fuel sales by the percent of local or non-local flight operations, as calculated from FAA ATADS annual airport operations reports. Emissions were calculated by multiplying the amount of fuel sales for each category (local and non-local) by emission factors from the U. S. EPA (https://www.epa.gov/sites/production/files/2020-04/documents/ghg-emission-factors-hub.pdf).

Aviation emissions from SJC were estimated using emissions estimates for taxi, take-off, and landing for 2018 from the Airport Master Plan Environmental Impact Report published in 2019, as reported in the CEQA Greenhouse Gas Emissions Final Technical Report. These emission estimates were calculated using the FAA Aviation Environmental Design Tool and detailed aircraft operations data from SJC (which included both airplanes and helicopters). Consistent with Table A-110 of the Annexes to the Inventory of U.S. Greenhouse Gas Emissions and Sinks, $CH_4$ emissions from aircraft burning jet fuel were not included. The 2018 emissions estimates were multiplied by the ratio of total flight operations in the inventory year (2008, 2014, 2017, or 2019) to total flight operations in 2018 to estimate emissions for each inventory year. Total emissions for each inventory year were then multiplied by the percent of local flights (calculated using data from FAA ATADS) to estimate emissions from local flights. Emissions from non-local flights for each inventory year were estimated using the following equation:

*Emissions from non-local flights = Total emissions x ((percent of passengers arriving in or departing from SJC, rather than connecting)-(percent of flights that are local))*

This calculation accounts for the fact that all connecting passengers are, by definition, on non-local flights. The percent of all passengers arriving in or departing from SJC ("O-D passengers") was calculated from data in SJC Airport Activity Reports available on the SJC website.

**Off-road vehicles and equipment.** Off-road vehicle and equipment emissions for all subsectors except airport Ground Support Equipment (GSE) were estimated using activity data from the CARB OFFROAD2017 ORION model v1.0.1 (https://arb.ca.gov/emfac/emissions-inventory). Gasoline, diesel, and compressed natural gas (CNG) usage data for Santa Clara County from the OFFROAD2017 model were downscaled to San José using jobs data from the "All workers, All jobs" analysis in the U.S. Census OnTheMap online tool (https://onthemap.ces.census.gov/), which presents data from the Longitudinal Employer-Household Dynamics (LEHD) Origin Destination Employment Statistics (LODES) dataset. Jobs in Agriculture, Forestry, Fishing and Hunting were used to downscale activity data for Agricultural off-road vehicles and equipment. Total jobs in Construction and Mining, Quarrying, and Oil and Gas Extraction were used to downscale activity data for Construction and Mining off-road vehicles and equipment. Total jobs in Agriculture, Forestry, Fishing and Hunting, Mining, Quarrying, and Oil and Gas Extraction, Utilities, Construction, and Manufacturing were counted as Industrial jobs and used to downscale activity data for Industrial off-road vehicles and equipment. Total jobs in Wholesale Trade, Retail Trade, and Transportation and Warehousing were used to downscale activity data for Light Commercial and Transportation Refrigeration off-road vehicles and equipment. Total jobs in all sectors were used to downscale activity data for off-road Portable Equipment. 2019 jobs numbers were not available at the time of inventory compilation, so 2018 jobs numbers were used as proxies. Emissions were calculated by multiplying the amount of fuel usage attributable to San José for each off-road category by emission factors from the U.S. EPA (https://www.epa.gov/sites/production/files/2020-04/documents/ghg-emission-factors-hub.pdf). For CNG usage, only $CO_2$ emissions were calculated, as $CH_4$ and $N_2O$ emission factors are per-mile, and no mileage data were available.

2014, 2017, and 2019 emissions for SJC GSE (including both City- and tenant-owned vehicles and equipment) were estimated using fuel pump data from SJC supplied by the Public Works Department. Emissions were calculated by multiplying the amount of fuel usage by emission factors from the U.S. EPA (https://www.epa.gov/sites/production/files/2020-04/documents/ghg-emission-factors-hub.pdf). Fuel pump data for 2008 were not available. For 2008 the emissions estimate from the EMFAC OFFROAD2007 model for airport GSE for Santa Clara County, which was used in the original 2008 San José GHG inventory, was used. Emissions from RHV GSE were excluded due to lack of data, but are expected to be minimal.

**Public transit (Buses and paratransit; Light rail).** Public transit emissions were estimated using emissions estimates for the entire VTA system, which were provided by VTA sustainability staff. These emissions estimates were recalculated using GWP values from the IPCC 5th Assessment Report. Emissions for each public transit category were multiplied by the ratio of San José to Santa Clara County service population (population plus jobs) to estimate San José emissions from the system-wide emissions. Population data came from the California Department of Finance (https://www.dof.ca.gov/Forecasting/Demographics/Estimates/; Tables E-5 and E-8). Total jobs data came from the U.S. Census OnTheMap online tool (as described in the off-road vehicles and equipment section above).

**Freight rail.** Freight rail emissions were estimated using rail emissions estimates (passenger plus freight rail) from the CARB statewide GHG inventory. The most recent statewide GHG inventory available at the time of inventory preparation did not include emissions estimates for 2019, so 2018 emissions estimates were used as a proxy for 2019 emissions. Rail emissions were multiplied by the ratio of San José to statewide freight rail miles to estimate San José emissions from statewide emissions. The statewide freight rail miles value came from the 2018 California State Rail Plan (https://dot.ca.gov/-/media/dot-media/programs/rail-mass-transportation/documents/rail-plan/2-chapter-2csrpfinal.pdf) and the number of freight rail miles in San José was calculated through geographic information system (GIS) analysis of a City map of rail lines in San José (https://gisdata-csj.opendata.arcgis.com/datasets/railroad). Freight rail emissions were calculated by subtracting commuter rail emissions from total rail emissions.

**Commuter rail.** Commuter rail emissions were estimated using activity data from the three commuter rail systems operating in San José: ACE (operated by the San Joaquin Regional Rail Commission), Caltrain, and Capitol Corridor (operated by Amtrak). ACE fuel use data were received from the San Joaquin Regional Rail Commission through a Public Records Act Request. Total ACE system miles came from the ACE website (https://acerail.com/). Data were provided for financial years (FY) rather than calendar years. Caltrain fuel use data came from the Caltrain 2017 and 2019 Sustainability Reports, available on the Caltrain website (https://www.caltrain.com/about/Sustainability.html). Data for FY 2010 were used for 2008; data for FY 2014 were used for 2014; data for FY 2017 were used for 2017; and data for FY 2018 were used for 2019 because data were provided for financial rather than calendar years, and were not available for all years. Total Caltrain system miles also came from the Caltrain 2019 Sustainability Report. Capitol Corridor fuel use data was received from Capitol Corridor staff. 2012 data were used for 2008 because data for earlier years were not available. Total Capitol Corridor system miles came from the 2018 California State Rail Plan (https://dot.ca.gov/-/media/dot-media/programs/rail-mass-transportation/documents/rail-plan/2-chapter-2csrpfinal.pdf). Fuel use for each system was multiplied by the ratio of San José to system rail miles to estimate fuel use from each system attributable to San José. The number of rail miles in San José for each system was calculated through GIS analysis of a City map of rail lines in San José (https://gisdata-csj.opendata.arcgis.com/datasets/railroad). Emissions were calculated by multiplying the amount of fuel usage attributable to San José for each rail system by emission factors from the U.S. EPA (https://www.epa.gov/sites/production/files/2020-04/documents/ghg-emission-factors-hub.pdf). Emissions were calculated for Caltrain shuttles as well as trains. For Caltrain shuttle CNG usage, only $CO_2$ emissions were calculated, as $CH_4$ and $N_2O$ emission factors are per-mile, and no mileage data were available specifically for Caltrain CNG vehicles.

## Buildings

**Natural gas (residential, commercial, industrial, and institutional).** Activity data for San José were received from PG&E in a Community Inventory report, which provides aggregated data on natural gas use by sector. Industrial non-governmental usage was included with commercial non-governmental usage due to privacy regulations. Emissions were estimated by multiplying usage data by emission factors from the USCP.

**Natural gas (onsite electricity generation).** As of 2020, PG&E does not include natural gas used to generate electricity in the Community Inventory reports it supplies to municipalities. Emissions data for on-site electricity generation facilities in San José were taken from the online CARB Pollution Mapping Tool (https://ww3.arb.ca.gov/ei/tools/pollution_map/), which publishes data collected by CARB through the Mandatory GHG Reporting program. For the San José State University (SJSU) cogeneration plant, 2019 data were downloaded from the CARB Mandatory GHG Reporting website (https://ww2.arb.ca.gov/mrr-data) because they were not yet available through the Pollution Mapping Tool. The spreadsheet downloaded from the CARB Mandatory GHG Reporting website only provides emissions data in $CO_2e$, calculated using GWP values from the IPCC Second Assessment Report. This $CO_2e$ value was used in this inventory report and will be updated in the future when 2019 data for the SJSU cogeneration plant become available through the Pollution Mapping Tool.

**Electricity (residential, commercial, industrial, and direct access).** Activity data for San José were received from PG&E in a Community Inventory report, which provides aggregated data on electricity use by sector. For 2019, activity data were also received from the City's Community Energy Department, which operates SJCE. 2008 and 2019 industrial non-governmental usage were included with commercial non-governmental usage due to privacy regulations. PG&E includes electricity supplied by SJCE in the direct access sector, and so the total amount of electricity supplied by SJCE was subtracted from the direct access usage reported from PG&E to calculate actual direct access electricity use.

$CO_2$ emissions were estimated by multiplying usage data by emission factors provided by PG&E and SJCE. $CH_4$ and $N_2O$ emissions were estimated by multiplying usage data by emission factors from the U.S. EPA Emissions & Generation Resource Integrated Database (eGRID) for the CAMX region. EGRID data are not released every year. For 2008, the averages of the 2007 and 2009 eGRID emission factors were used. For 2017, the averages of the 2016 and 2018 eGRID emission factors were used. The 2018 eGRID emission factors were used for 2019.

Emissions from electricity used by VTA electric buses and light rail were subtracted from the industrial electricity emissions total, because they were counted in the Transportation sector. Emissions from electricity used for wastewater treatment were also subtracted from the industrial electricity emissions total, because they were counted in the Wastewater sector.

**Electricity (transmission and distribution losses).** Emissions from electricity lost during transmission and distribution were estimated using the grid gross loss factors reported in eGRID for the CAMX region. EGRID data are not released every year. For 2008, the averages of the 2007 and 2009 eGRID grid gross loss factors were used. For 2017, the averages of the 2016 and 2018 eGRID e grid gross loss factors were used. The 2018 eGRID grid gross loss factors were used for 2019. Emissions were estimated by multiplying the total emissions from electricity use for each year by the grid gross loss factor for that year.

**Other residential fuels.** Emissions from residential heating fuels other than natural gas were estimated using emissions estimates for residential wood, distillate fuel, kerosene, and liquefied petroleum gas (LPG) use from the CARB statewide GHG inventory. The most recent statewide GHG inventory available at the time of inventory preparation did not include emissions estimates for 2019, so 2018 emissions estimates were used as a proxy for 2019 emissions. Statewide residential heating fuel emissions were multiplied by the ratio of San José to statewide households using different kinds of fuels to estimate San José emissions from statewide emissions. The number of households using wood, fuel oil/kerosene, and bottled/tank/LPG fuel for heating, statewide and in San José, came from the American Community Survey House Heating Fuel table (five-year estimates). 2010 American Community Survey data were used as a proxy for 2008 because earlier five-year estimates were not available for San José.

## Process and fugitive emissions

**Fugitive HFCs and PFCs.** Emissions of fugitive HFCs and PFCs were estimated using emissions estimates for ODS (ozone-depleting substance) substitutes from the CARB statewide GHG inventory. The most recent statewide GHG inventory available at the time of inventory preparation did not include emissions estimates for 2019, so 2018 emissions estimates were used as a proxy for 2019 emissions. Statewide HFC and PFC emissions were multiplied by the ratio of San José to statewide jobs or population (depending on the use sector) to estimate San José emissions. Population data came from the California Department of Finance (https://www.dof.ca.gov/Forecasting/Demographics/Estimates/; Table E-5 and E-8). Jobs data came from the U.S. Census OnTheMap online tool (described in the off-road vehicles and equipment section above). 2019 jobs numbers were not available at the time of inventory compilation, so 2018 jobs numbers were used as proxies. Population data were used to estimate San José HFC and PFC emissions from residential use. Total jobs in Agriculture, Forestry, Fishing and Hunting, Mining, Quarrying, and Oil and Gas Extraction, Utilities, Construction, and Manufacturing were counted as Industrial jobs and used to estimate San José HFC and PFC emissions from industrial use. Total jobs in Transportation and Warehousing were counted as Transportation jobs and used to estimate San José HFC and PFC emissions from transportation. Total jobs in the remaining job categories (Wholesale Trade, Retail Trade, Information, Finance and Insurance, Real Estate and Rental and Leasing, Professional, Scientific and Technical Services, Management, Administration & Support, Waste Management and Remediation, Educational Services, Health Care and Social Assistance, Arts, Entertainment, and Recreation, Accommodation and Food Services, Public Administration, and Other Services) were counted as Commercial jobs and used to estimate San José HFC and PFC emissions from commercial use.

**Fugitive natural gas.** Emissions from fugitive natural gas were estimated using natural gas activity data (described in the Buildings section above) and an estimate of the leakage rate of natural gas from distribution infrastructure in the Bay Area from a 2016 study by Jeong et al.[14] Total emissions were calculated using the following formulas, based on methods in the ICLEI ClearPath tool:

*$CH_4$ emissions = total natural gas use x ((1/(1-leakage rate))-1) x (1/natural gas energy density) x natural gas density x percentage of $CH_4$ in natural gas*

*$CO_2$ emissions = total natural gas use x ((1/(1-leakage rate))-1) x (1/natural gas energy density) x natural gas density x percentage of $CO_2$ in natural gas*

The following standard values were used for all inventory years:

Leakage rate = 0.4%

Natural gas density = 0.8 kg per cubic meter

Percent $CH_4$ in natural gas = 93.4%

Percent $CO_2$ in natural gas = 1%

Data for natural gas energy density were taken from U.S. Energy Information Administration (EIA) tables on the heat content of natural gas deliveries to customers in California (https://www.eia.gov/dnav/ng/hist/nga_epg0_vgth_sca_btucfa.htm).

[14] Jeong, S., et al. 2017. Estimating methane emissions from biological and fossil-fuel sources in the San Francisco Bay Area. Geophys. Res. Lett. 44, 486– 495. doi:10.1002/2016GL071794.

**Industrial process emissions.** Data on emissions from semiconductor manufacturing in San José (the only industry generating significant amounts of process emissions) were downloaded from the U.S. EPA FLIGHT tool (https://ghgdata.epa.gov/ghgp/main.do). Data were downloaded for all facilities in San José listed in the FLIGHT tool database. Data from 2011 were used as a proxy for 2008 because data for earlier years were not available.

**Fugitive $SF_6$.** Emissions of fugitive $SF_6$ from electricity transmission and distribution were estimated using fugitive $SF_6$ emissions estimates from the CARB statewide GHG inventory. The most recent statewide GHG inventory available at the time of inventory preparation did not include emissions estimates for 2019, so 2018 emissions estimates were used as a proxy for 2019 emissions. Statewide emissions were multiplied by the ratio of San José to statewide population to estimate San José emissions. Population data came from the California Department of Finance (https://www.dof.ca.gov/Forecasting/Demographics/Estimates/; Table E-5 and E-8).

## Solid waste

Solid waste emissions estimates were based on activity data provided by the Integrated Waste Management Division (IWM) in ESD. Waste tonnages were estimated for each combination of material type and disposal method (recycling, landfill, composting, anaerobic digestion, or incineration). 2019 waste tonnages were estimated by Environmental Science Associates and Abbe & Associates as part of a Zero Waste Plan update, using information from IWM, the California Department of Resources Recycling and Recovery (CalRecycle), and Zanker Recycling. 2008, 2014, and 2017 waste tonnages were estimated by IWM using the 2019 waste tonnage estimates and historical data on waste tonnages, waste characterizations, and program changes.

Emissions from composting and waste sent to landfill were calculated using emission factors from ICLEI ClearPath. For waste sent to landfill, landfill methane collection was assumed to follow the "California regulatory" scenario, and landfill moisture content was assumed to be "dry." CalRecycle data on "Jurisdiction Disposal and ADC Tons by Facility" was used to calculate the percent of landfilled waste in each inventory year that was sent to landfills with or without methane collection. Data on whether landfills have methane collection systems came from the U.S. EPA Landfill Methane Outreach Program (LMOP) database (https://www.epa.gov/lmop/lmop-landfill-and-project-database). Landfills that were not in the LMOP database were assumed not to have methane collection systems.

Emissions from anaerobically digested waste were calculated using emission factors provided by Sarah Nordahl and Corinne Scown, researchers from LBNL who published a study of GHG emissions from ZWED, the anaerobic digestion facility in San José.[15]

Emissions from incinerated waste were not included because solid waste from San José that is incinerated is incinerated at the Covanta Stanislaus waste-to-energy facility. Because waste-to-energy facilities supply electricity to the grid, their emissions are already accounted for in electricity emission factors and should not be counted in the solid waste sector.

[15] Sarah L. Nordahl, Jay P. Devkota, Jahon Amirebrahimi, Sarah Josephine Smith, Hanna M. Breunig, Chelsea V. Preble, Andrew J. Satchwell, Ling Jin, Nancy J. Brown, Thomas W. Kirchstetter, and Corinne D. Scown. 2020. Environmental Science & Technology 54 (15), 9200-9209. DOI: 10.1021/acs.est.0c00364.

Emissions avoided by recycling, composting, and anaerobic digestion were estimated by calculating the difference in emissions if those wastes had been landfilled instead.

## Wastewater treatment

**Energy use.** Emissions data from the combustion of digester gas, landfill gas, natural gas, and diesel at the Wastewater Facility were taken from reports submitted by the Wastewater Facility to CARB's electronic Greenhouse Gas Reporting Tool (Cal e-GGRT). To calculate emissions from electricity use, electricity use data from Wastewater Facility Cal e-GGRT reports was multiplied by PG&E and eGRID emission factors as described in the electricity section above. The amount of Wastewater Facility energy use emissions attributable to San José was calculated by multiplying total emissions by the ratio of San José's population to the Wastewater Facility's service population. Population data came from the California Department of Finance (https://www.dof.ca.gov/Forecasting/Demographics/Estimates/; Table E-5 and E-8). Information on the Wastewater Facility's service population over time was provided by the Wastewater Facility.

**Process emissions.** $N_2O$ emissions from nitrification/denitrification during the treatment process and from effluent were calculated using equations WW.7 and WW.12 and the standard emission factors from the USCP. For emissions from nitrification/denitrification, an industrial commercial discharge multiplier of 1.25 was used. For emissions from effluent, data on inorganic nitrogen in effluent rather than total nitrogen were used because the organic nitrogen in Wastewater Facility effluent after treatment is not bioavailable, and the emission factor for discharge to a river or stream was used. The amount of Wastewater Facility process emissions attributable to San José was calculated by multiplying total emissions by the ratio of San José's population to the Wastewater Facility's service population, as described above for wastewater treatment energy use.

## Forests and trees

**Forests.** Emissions and sequestration by forests were calculated for 2008 and 2014 using ICLEI's online Land Emissions And Removals Navigator (LEARN) tool (https://icleiusa.org/learn/), which uses NLCD land cover data. Emission factors for the Pacific Southwest Forest Region were used. Average annual changes in land cover and forest disturbance were calculated for 2008 by comparing NLCD data for 2006 and 2011, and for 2014 by comparing NLCD data for 2013 and 2016. NLCD data are not yet available for any year later than 2016, so 2014 emissions and sequestration estimates were used as proxies for 2017 and 2019.

**Urban trees.** Emissions and sequestration by urban trees were calculated using the methods in Appendix J of the USCP for trees outside forests. Urban tree canopy cover and the change in urban tree canopy over time were estimated using data from the 2021 San José Community Forest Management Plan (CFMP). The tree cover values in the CFMP were calculated using 2012 and 2018 datasets from the U.S. Forest Service for California urban tree canopy. These two tree cover values were used to estimate an average annual change in tree canopy, and this value was used for all inventory years. The 2012 and 2018 tree cover values were also used to estimate tree cover in all inventory years, by assuming a constant change in tree canopy over time. These activity data were then multiplied by emission factors for trees outside forests for Sacramento from the LEARN tool.

## Emissions sectors not included in the inventory total

**Water delivery.** 2014, 2017, and 2019 data on water supplied by the San José Municipal Water System, San Jose Water Company, and Great Oaks Water Company were provided by the San José Municipal Water System. 2008 data on water supplied came from the three organizations' Urban Water Management Plans (UWMPs). 2008 data for the San José Municipal Water System came from Table 5-1 of their 2015 UWMP; 2008 data for San Jose Water Company came from Table 15 of their 2010 UWMP; and 2008 data for Great Oaks Water Company came from Table 19B of their 2010 UWMP. Approximately 80% of San Jose Water Company customers are in San José, so San Jose Water Company numbers were multiplied by 0.8 in order to estimate water supplied to San José customers. Data on the percent of water supplied from groundwater for each water supplier came from their 2010 and 2015 UWMPs.

Electricity used for the treatment and distribution of water by each water supplier was estimated using the following formulas:

*Electricity used = (amount of water supplied) x ((percent of water supplied from groundwater x energy intensity of groundwater extraction and distribution) + (percent of water supplied from surface water x energy intensity of surface water treatment and distribution))*

*Energy intensity of groundwater extraction and distribution = energy intensity of groundwater extraction + energy intensity of booster pumps + energy intensity of raw water pumps + energy intensity of pressure system pumps*

*Energy intensity of surface water treatment and distribution = energy intensity of water treatment + energy intensity of booster pumps + energy intensity of raw water pumps + energy intensity of pressure system pumps*

Energy intensity values came from the profile of San Jose Water Company in Appendix B of Embedded Energy in Water Studies, Study 2: Water Agency and Function Component Study and Embedded Energy-Water Load Profiles, a 2010 report commissioned by the California Public Utilities Commission (CPUC) Energy Division. Energy intensities for the San José Municipal Water System and Great Oaks Water Company were assumed to be the same as those for San Jose Water Company.

Emissions from water treatment and distribution were calculated from electricity use using $CO_2$, $CH_4$, and $N_2O$ emission factors from eGRID for the CAMX region, as described in the Electricity (residential, commercial, industrial, and direct access) section of this Appendix.

**Electricity generated for supply to the electric grid.** Emissions data for power plants in San José came from reports made to CARB by each facility. 2008, 2014, and 2017 emissions estimates came from CARB's online Pollution Mapping Tool (https://ww3.arb.ca.gov/ei/tools/pollution_map/). At the time of data collection for this report, 2019 data were not yet available in the Pollution Mapping Tool. 2019 data were downloaded from CARB's website about California's Regulation for the Mandatory Reporting of Greenhouse Gas Emissions (MRR) (https://ww2.arb.ca.gov/mrr-data). The MRR datasets provide values only for $CO_2e$, not individual GHGs. These $CO_2e$ values were calculated using GWP values from the IPCC Fourth Assessment, unlike the rest of this inventory.

# Data Tables

***Table A-1*** *Activity data (continued on next page)*

| SECTOR | SUBSECTOR | Activity Data 2008 | 2014 | 2017 | 2019 | Scale | Units | Source |
|---|---|---|---|---|---|---|---|---|
| Electricity | PG&E | | | | | | | |
| | Residential | 1,958,321,849 | 1,836,528,385 | 1,802,871,457 | 319,759,899 | Citywide | kwh | PG&E |
| | Commercial | 3,522,421,672 | 2,258,779,752 | 2,252,166,169 | 610,458,217 | Citywide | kwh | PG&E |
| | Industrial | 110,759,676 | 746,439,897 | 725,909,226 | 15,932,527 | Citywide | kwh | PG&E |
| | Direct Access | 900,979,987 | 1,363,345,739 | 1,253,696,447 | 1,573,930,359 | Citywide | kwh | PG&E |
| | **Total** | **6,492,483,184** | **6,205,093,773** | **6,034,643,299** | **2,520,081,002** | Citywide | **kwh** | **Calculated** |
| | SJCE | | | | | | | |
| | Commercial - Green Source | | | | 1,479,440,000 | Citywide | kwh | SJCE |
| | Commercial - Total Green | | | | 14,390,000 | Citywide | kwh | SJCE |
| | Residential - Green Source | | | | 1,307,610,000 | Citywide | kwh | SJCE |
| | Residential - Total Green | | | | 1,250,000 | Citywide | kwh | SJCE |
| | Industrial - Green Source | | | | 407,240,000 | Citywide | kwh | SJCE |
| | Industrial - Total Green | | | | 0 | Citywide | kwh | SJCE |
| | **Total** | | | | **3,209,930,000** | Citywide | **kwh** | **Calculated** |
| | **TOTAL (PG&E + SJCE)** | **6,492,483,184** | **6,205,093,773** | **6,034,643,299** | **5,730,011,002** | Citywide | **kwh** | **Calculated** |
| | Transmission and distribution losses | 6.52% | 4.79% | 4.52% | 4.80% | Regional | Percent | eGRID (CAMX region) |
| Natural Gas | Residential | 127,351,363 | 101,606,392 | 112,160,230 | 114,867,292 | Citywide | therms | PG&E |
| | Commercial | 64,708,265 | 59,336,376 | 65,929,687 | 65,657,553 | Citywide | therms | PG&E |
| | Industrial | 2,029,430 | 1,922,238 | 2,254,104 | 2,297,416 | Citywide | therms | PG&E |
| | County government | 2,254,983 | 2,295,338 | 2,554,537 | 2,782,483 | Citywide | therms | PG&E |
| | City government | 2,061,571 | 2,120,021 | 1,846,149 | 1,735,209 | Citywide | therms | PG&E |
| | District government | 4,268,923 | 2,694,039 | 3,168,347 | 3,101,733 | Citywide | therms | PG&E |
| | **TOTAL** | **194,089,058** | **162,865,006** | **180,344,021** | **182,822,261** | Citywide | **therms** | **Calculated** |
| Wastewater | Digester gas use | 507,190,000 | 504,408,730 | 481,550,070 | 564,160,434 | Facility | scf | RWF |
| | Landfill gas use | 438,000,000 | 0 | 0 | 0 | Facility | scf | RWF |
| | Diesel fuel use | 27,372 | 29,036 | 16,795 | 21,334 | Facility | gallons | RWF |
| | Natural gas use | 317,925 | 550,120 | 363,912 | 406,331 | Facility | MMBtu | RWF |
| | Electricity use | 26,943 | 19,124 | 36,881 | 25,684 | Facility | MWh | RWF |
| | Inorganic nitrogen load in effluent | 4,952 | 4,952 | 5,562 | 5,418 | Facility | kg nitrogen/day | RWF |
| | Service population | 1,400,000 | 1,400,000 | 1,400,000 | 1,500,000 | Facility | people | RWF |
| Transportation | Caltrain | | | | | | | |
| | Caltrain revenue fleet diesel use | 4296357 | 4289258 | 4478040 | 4234870 | Regional | gallons | Caltrain sustainability reports |
| | Caltrain revenue fleet gasoline use | 79167 | 86886 | 105150 | 99406 | Regional | gallons | Caltrain sustainability reports |
| | Caltrain revenue fleet CNG use | 0 | 14441 | 8204 | 6324 | Regional | GGE | Caltrain sustainability reports |
| | Caltrain revenue fleet biodiesel use | 0 | 7057 | 0 | 0 | Regional | gallons | Caltrain sustainability reports |
| | ACE | | | | | | | |
| | ACE trains diesel use | 477274 | 496239 | 462256 | 506620 | Regional | gallons | ACE |
| | Amtrak/Capitol Corridor | | | | | | | |
| | Amtrak/Capitol Corridor trains diesel use | 2251964 | 2203942 | 2048014 | 1900656 | Regional | gallons | Capitol Corridor |
| | Offroad | | | | | | | |
| | Agricultural | 1,032,763 | 1,023,593 | 1,019,112 | 1,016,163 | Countywide | gallons of diesel | CARB OFFROAD2017 |
| | Airport Ground Support | 132,834 | 134,476 | 148,073 | 152,347 | Countywide | gallons of diesel | CARB OFFROAD2017 |
| | Construction and Mining | 17,431,654 | 9,987,408 | 8,486,983 | 7,133,391 | Countywide | gallons of diesel | CARB OFFROAD2017 |
| | Industrial | 2,395,917 | 2,054,029 | 2,321,600 | 2,499,980 | Countywide | gallons of diesel | CARB OFFROAD2017 |
| | Locomotive - Line haul | 0 | 0 | 0 | 0 | Countywide | gallons of diesel | CARB OFFROAD2017 |
| | Locomotive - Passenger | 0 | 0 | 0 | 0 | Countywide | gallons of diesel | CARB OFFROAD2017 |
| | OFFROAD - Agricultural | 139,638 | 139,905 | 140,645 | 142,036 | Countywide | gallons of gasoline | CARB OFFROAD2017 |
| | OFFROAD - Agricultural | 152,771 | 148,007 | 145,690 | 144,124 | Countywide | gallons of diesel | CARB OFFROAD2017 |
| | OFFROAD - Airport Ground Support | 644,904 | 698,964 | 726,018 | 744,261 | Countywide | gallons of gasoline | CARB OFFROAD2017 |
| | OFFROAD - Airport Ground Support | 75,186 | 82,034 | 85,169 | 87,297 | Countywide | GGE of CNG | CARB OFFROAD2017 |
| | OFFROAD - Construction and Mining | 622,789 | 653,193 | 669,279 | 680,699 | Countywide | gallons of gasoline | CARB OFFROAD2017 |
| | OFFROAD - Construction and Mining | 133,729 | 146,982 | 153,705 | 158,224 | Countywide | gallons of diesel | CARB OFFROAD2017 |
| | OFFROAD - Industrial | 8,259,673 | 8,914,983 | 9,254,400 | 9,477,521 | Countywide | gallons of gasoline | CARB OFFROAD2017 |
| | OFFROAD - Industrial | 73,810 | 80,315 | 83,329 | 85,344 | Countywide | gallons of diesel | CARB OFFROAD2017 |
| | OFFROAD - Industrial | 14,666,634 | 15,951,719 | 16,563,547 | 16,970,598 | Countywide | GGE of CNG | CARB OFFROAD2017 |
| | OFFROAD - Light Commercial | 2,964,972 | 3,066,135 | 3,145,723 | 3,211,708 | Countywide | gallons of gasoline | CARB OFFROAD2017 |
| | OFFROAD - Light Commercial | 656,989 | 710,067 | 734,289 | 750,681 | Countywide | gallons of diesel | CARB OFFROAD2017 |
| | OFFROAD - Light Commercial | 623,238 | 680,210 | 706,370 | 723,864 | Countywide | GGE of CNG | CARB OFFROAD2017 |
| | OFFROAD - Oil Drilling | 0 | 0 | 0 | 0 | Countywide | gallons of diesel | CARB OFFROAD2017 |
| | Oil Drilling | 2,049 | 2,038 | 2,027 | 2,024 | Countywide | gallons of diesel | CARB OFFROAD2017 |
| | Portable Equipment | 6,335,981 | 7,702,612 | 8,221,486 | 8,553,635 | Countywide | gallons of diesel | CARB OFFROAD2017 |
| | Transportation Refrigeration Unit | 8,013 | 7,794 | 7,962 | 8,255 | Countywide | gallons of diesel | CARB OFFROAD2017 |
| | Airport GSE | | | | | | | |
| | SJC airport vehicles and GSE gasoline use | no data | 12,624 | 36,175 | 55,318 | Facility | gallons | PWD |
| | SJC airport vehicles and GSE diesel use | no data | 5,700 | 22,787 | 25,163 | Facility | gallons | PWD |
| | Aviation | | | | | | | |
| | Reid-Hillview total jet fuel sales | 307,378 | 296,294 | 247,162 | 247,162 | Facility | gallons | RHV |
| | Reid-Hillview total aviation gasoline sales | 0 | 26,177 | 44,389 | 44,389 | Facility | gallons | RHV |
| | On-road - City model | | | | | | | |
| | on-road traffic - speed bin 5 | 22,993,084 | 35,047,987 | | | Citywide | annual VMT | City model |
| | on-road traffic - speed bin 10 | 42,802,622 | 116,704,572 | | | Citywide | annual VMT | City model |
| | on-road traffic - speed bin 15 | 142,495,948 | 321,796,884 | | | Citywide | annual VMT | City model |
| | on-road traffic - speed bin 20 | 304,528,440 | 621,874,187 | | | Citywide | annual VMT | City model |
| | on-road traffic - speed bin 25 | 1,468,677,964 | 1,227,513,796 | | | Citywide | annual VMT | City model |
| | on-road traffic - speed bin 30 | 882,985,080 | 991,761,566 | | | Citywide | annual VMT | City model |
| | on-road traffic - speed bin 35 | 669,632,138 | 508,722,625 | | | Citywide | annual VMT | City model |
| | on-road traffic - speed bin 40 | 365,346,244 | 312,500,921 | | | Citywide | annual VMT | City model |
| | on-road traffic - speed bin 45 | 448,566,856 | 306,865,169 | | | Citywide | annual VMT | City model |
| | on-road traffic - speed bin 50 | 580,889,712 | 256,531,706 | | | Citywide | annual VMT | City model |
| | on-road traffic - speed bin 55 | 1,824,575,294 | 1,261,253,991 | | | Citywide | annual VMT | City model |
| | on-road traffic - speed bin 60 | 0 | 0 | | | Citywide | annual VMT | City model |
| | on-road traffic - speed bin 65 | 0 | 0 | | | Citywide | annual VMT | City model |
| | **TOTAL** | **6,753,493,382** | **5,960,573,404** | | | **Citywide** | **annual VMT** | **City model** |
| | On-road - Google EIE | | | | | | | |
| | On-road traffic (cars and trucks) | | | 5,720,871,350 | 5,561,069,981 | Citywide | annual VMT | Google EIE |
| | Walking | | | | 56,872,851 | Citywide | annual VMT | Google EIE |
| | Biking | | | | 22,342,407 | Citywide | annual VMT | Google EIE |

## *Table A-1* continued

| SECTOR | SUBSECTOR | Activity Data 2008 | 2014 | 2017 | 2019 | Scale | Units | Source |
|---|---|---|---|---|---|---|---|---|
| Solid Waste | Landfill | | | | | | | |
| | Residential Mixed municipal solid waste (MSW) sent to landfill | 61,688 | 61,688 | 61,688 | 61,688 | Citywide | short tons | IWM |
| | Residential Newspaper sent to landfill | 63 | 63 | 63 | 63 | Citywide | short tons | IWM |
| | Residential Office paper sent to landfill | 10,117 | 10,117 | 10,117 | 10,117 | Citywide | short tons | IWM |
| | Residential Corrugated cardboard sent to landfill | 6,882 | 6,882 | 6,882 | 6,882 | Citywide | short tons | IWM |
| | Residential Food scraps sent to landfill | 85,011 | 70,961 | 18,411 | 2,461 | Citywide | short tons | IWM |
| | Residential Grass sent to landfill | 14,072 | 11,489 | 2,939 | 322 | Citywide | short tons | IWM |
| | Residential Leaves sent to landfill | 14,072 | 11,489 | 2,939 | 322 | Citywide | short tons | IWM |
| | Residential Branches sent to landfill | 14,072 | 11,489 | 2,939 | 322 | Citywide | short tons | IWM |
| | Residential Dimensional Lumber sent to landfill | 4,708 | 4,708 | 4,708 | 4,708 | Citywide | short tons | IWM |
| | Commercial Mixed MSW sent to landfill | 27,263 | 18,237 | 19,317 | 20,018 | Citywide | short tons | IWM |
| | Commercial Office paper sent to landfill | 7,864 | 14,025 | 14,856 | 15,395 | Citywide | short tons | IWM |
| | Commercial Corrugated cardboard sent to landfill | 28,172 | 10,356 | 10,970 | 11,368 | Citywide | short tons | IWM |
| | Commercial Magazines/Third Class Mail sent to landfill | 5,481 | 3,669 | 3,886 | 4,027 | Citywide | short tons | IWM |
| | Commercial Food scraps sent to landfill | 10,052 | 1,896 | 2,008 | 2,081 | Citywide | short tons | IWM |
| | Commercial Grass sent to landfill | 4,744 | 632 | 669 | 694 | Citywide | short tons | IWM |
| | Commercial Leaves sent to landfill | 4,744 | 632 | 669 | 694 | Citywide | short tons | IWM |
| | Commercial Branches sent to landfill | 4,744 | 632 | 669 | 694 | Citywide | short tons | IWM |
| | Commercial Dimensional Lumber sent to landfill | 6,542 | 0 | 0 | 0 | Citywide | short tons | IWM |
| | C&D/Other Mixed MSW sent to landfill | 103,180 | 89,942 | 154,692 | 137,433 | Citywide | short tons | IWM |
| | C&D/Other Newspaper sent to landfill | 367 | 318 | 552 | 488 | Citywide | short tons | IWM |
| | C&D/Other Office paper sent to landfill | 5,436 | 4,944 | 7,290 | 6,644 | Citywide | short tons | IWM |
| | C&D/Other Corrugated cardboard sent to landfill | 5,855 | 3,739 | 8,431 | 5,339 | Citywide | short tons | IWM |
| | C&D/Other Food scraps sent to landfill | 16,026 | 14,902 | 20,767 | 19,325 | Citywide | short tons | IWM |
| | C&D/Other Grass sent to landfill | 9,868 | 8,777 | 14,798 | 13,419 | Citywide | short tons | IWM |
| | C&D/Other Leaves sent to landfill | 9,868 | 8,777 | 14,798 | 13,419 | Citywide | short tons | IWM |
| | C&D/Other Branches sent to landfill | 17,114 | 14,985 | 25,699 | 22,941 | Citywide | short tons | IWM |
| | C&D/Other Dimensional Lumber sent to landfill | 25,230 | 12,533 | 36,946 | 18,096 | Citywide | short tons | IWM |
| | **Total residential waste sent to landfill** | **244,225** | **222,425** | **144,225** | **120,425** | **Citywide** | **short tons** | **IWM** |
| | **Total commercial waste sent to landfill** | **274,547** | **76,371** | **80,894** | **83,829** | **Citywide** | **short tons** | **IWM** |
| | **Total C&D/other sent to landfill** | **343,620** | **270,630** | **504,307** | **401,840** | **Citywide** | **short tons** | **IWM** |
| | **Total solid waste sent to landfill** | **862,391** | **569,425** | **729,426** | **606,093** | **Citywide** | **short tons** | **IWM** |
| | % waste sent to landfills with methane collection | 98% | 100% | 91% | 89% | Citywide | percent | calculated |
| | % waste sent to landfills without methane collection (or no info) | 2% | 0% | 9% | 11% | Citywide | percent | calculated |
| | Recycling | | | | | | | |
| | Residential Newspaper recycled | 6,986 | 6,986 | 6,986 | 6,986 | Citywide | short tons | IWM |
| | Residential Office paper recycled | 32,426 | 32,426 | 32,426 | 32,426 | Citywide | short tons | IWM |
| | Residential Corrugated cardboard recycled | 24,139 | 24,139 | 24,139 | 24,139 | Citywide | short tons | IWM |
| | Residential Dimensional Lumber recycled | 120 | 120 | 120 | 120 | Citywide | short tons | IWM |
| | Commercial Newspaper recycled | 0 | 25,204 | 0 | 0 | Citywide | short tons | IWM |
| | Commercial Office paper recycled | 13,097 | 8,454 | 0 | 0 | Citywide | short tons | IWM |
| | Commercial Corrugated cardboard recycled | 6,193 | 21,845 | 14,249 | 14,511 | Citywide | short tons | IWM |
| | Commercial Dimensional Lumber recycled | 0 | 0 | 4,938 | 5,029 | Citywide | short tons | IWM |
| | C&D/Other Newspaper recycled | 123 | 194 | 194 | 310 | Citywide | short tons | IWM |
| | C&D/Other Office paper recycled | 1,842 | 2,628 | 2,628 | 3,897 | Citywide | short tons | IWM |
| | C&D/Other Corrugated cardboard recycled | 3,125 | 4,542 | 4,542 | 6,805 | Citywide | short tons | IWM |
| | C&D/Other Dimensional Lumber recycled | 23,559 | 35,886 | 36,604 | 56,356 | Citywide | short tons | IWM |
| | **Total residential waste recycled** | **101,885** | **101,885** | **101,885** | **101,885** | **Citywide** | **short tons** | **IWM** |
| | **Total commercial waste recycled** | **21,772** | **106,928** | **123,422** | **125,698** | **Citywide** | **short tons** | **IWM** |
| | **Total C&D/other waste recycled** | **111,382** | **169,093** | **171,453** | **264,219** | **Citywide** | **short tons** | **IWM** |
| | **Total solid waste recycled** | **235,039** | **377,906** | **396,759** | **491,802** | **Citywide** | **short tons** | **IWM** |
| | Composting | | | | | | | |
| | Residential Green waste composted | 140,090 | 147,840 | 173,490 | 181,340 | Citywide | short tons | IWM |
| | Residential Food waste composted | 17,257 | 31,307 | 83,857 | 99,807 | Citywide | short tons | IWM |
| | Commercial Green waste composted | 13,471 | 10,411 | 14,292 | 14,728 | Citywide | short tons | IWM |
| | Commercial Food waste composted | 17,649 | 10,411 | 14,292 | 14,728 | Citywide | short tons | IWM |
| | C&D/Other Green waste composted | 5,322 | 5,322 | 5,322 | 5,322 | Citywide | short tons | IWM |
| | C&D/Other Food waste composted | 0 | 0 | 0 | 0 | Citywide | short tons | IWM |
| | **Total residential waste composted** | **157,347** | **179,147** | **257,347** | **281,147** | **Citywide** | **short tons** | **IWM** |
| | **Total commercial waste composted** | **31,121** | **20,821** | **28,584** | **29,455** | **Citywide** | **short tons** | **IWM** |
| | **Total C&D/other waste composted** | **5,322** | **5,322** | **5,322** | **5,322** | **Citywide** | **short tons** | **IWM** |
| | **Total solid waste composted** | **193,790** | **205,290** | **291,253** | **281,147** | **Citywide** | **short tons** | **IWM** |
| | Anaerobic digestion | | | | | | | |
| | Commercial waste sent to ZWED | 0 | 44,235 | 49,455 | 38,388 | Citywide | short tons | IWM |
| Forests and Trees | | | | | | | | |
| | Forest remaining forest - undisturbed | 2,664 | 2,637 | 2,637 | 2,637 | Citywide | hectares | NLCD/ICLEI LEARN tool |
| | Forest remaining forest - disturbed by fire | 0 | 0 | 0 | 0 | Citywide | hectares | NLCD/ICLEI LEARN tool |
| | Forest remaining forest - disturbed by insects/disease | 0 | 0 | 0 | 0 | Citywide | hectares | NLCD/ICLEI LEARN tool |
| | Forest remaining forest - disturbed by harvest/other | 1 | 7 | 7 | 7 | Citywide | hectares | NLCD/ICLEI LEARN tool |
| | Forest converted to Cropland | 0 | 0 | 0 | 0 | Citywide | hectares/year | NLCD/ICLEI LEARN tool |
| | Forest converted to Grassland | 0 | 9 | 9 | 9 | Citywide | hectares/year | NLCD/ICLEI LEARN tool |
| | Forest converted to Settlement | 0 | 0 | 0 | 0 | Citywide | hectares/year | NLCD/ICLEI LEARN tool |
| | Forest converted to Wetland | 0 | 0 | 0 | 0 | Citywide | hectares/year | NLCD/ICLEI LEARN tool |
| | Forest converted to Other | 0 | 0 | 0 | 0 | Citywide | hectares/year | NLCD/ICLEI LEARN tool |
| | Total: Forest converted to non-forest | 0 | 9 | 9 | 9 | Citywide | hectares/year | NLCD/ICLEI LEARN tool |
| | Non-forest converted to Forest | 8 | 1 | 1 | 1 | Citywide | hectares | NLCD/ICLEI LEARN tool |
| | Trees outside forest - canopy maintained/gained | 6,382 | 5,682 | 5,333 | 5,100 | Citywide | hectares/year | 2021 San Jose CFMP |
| | Trees outside forest - canopy loss | 117 | 117 | 117 | 117 | Citywide | hectares/year | 2022 San Jose CFMP |
| Water Delivery | | | | | | | | |
| | Total water supplied by San Jose Municipal Water System | 7,262 | 6,273 | 5,496 | 5,497 | Citywide | million gallons | San Jose Municipal Water/UWMP |
| | Total water supplied by San Jose Water Company | 45,625 | 38,947 | 36,360 | 36,936 | Systemwide | million gallons | San Jose Municipal Water/UWMP |
| | Total water supplied by Great Oaks Water Company | 4,404 | 3,534 | 3,257 | 3,386 | Citywide | million gallons | San Jose Municipal Water/UWMP |
| | SJWC percent groundwater | 38% | 38% | 38% | 38% | Citywide | percent | UWMPs |
| | Great Oaks percent groundwater | 100% | 100% | 100% | 100% | Citywide | percent | UWMPs |
| | Muni Water percent groundwater | 3% | 7% | 7% | 7% | Citywide | percent | UWMPs |

## *Table A-2* Emission factors (continued on next page)

| SECTOR | SUBSECTOR | Emission Factors 2008 | 2014 | 2017 | 2019 | Units | Source |
|---|---|---|---|---|---|---|---|
| Electricity | PG&E CO2 emissions factor | 0.64 | 0.43 | 0.21 | 0.21 | lbs CO2 per kWh | PG&E |
| | SJCE CO2 emissions factor - Green Source | | | | 0.086 | MT CO2 per MWh | SJCE |
| | SJCE CO2 emissions factor - Total Green | | | | 0 | MT CO2 per MWh | SJCE |
| | CAMX CO2 emissions factor | 669.85 | 568.60 | 512.18 | 496.50 | lbs CO2 per MWh | eGRID |
| | CAMX CH4 emissions factor | 28.62 | 33.10 | 33.50 | 34.00 | lbs CH4 per GWh | eGRID |
| | CAMX N2O emissions factor | 6.20 | 4.00 | 4.00 | 4.00 | lbs N2O per GWh | eGRID |
| Natural Gas | Standard CH4 emissions factor for Residential and Commercial | 0.005 | | same for all years | | kg CH4 per MMBtu | USCP |
| | Standard CH4 emissions factor for Industrial | 0.001 | | same for all years | | kg CH4 per MMBtu | USCP |
| | Standard N2O emissions factor | 0.0001 | | same for all years | | kg N2O per MMBtu | USCP |
| | Standard CO2 emissions factor for natural gas | 53.06 | | same for all years | | kg CO2 per MMBtu | U. S. EPA |
| Wastewater | N2O from effluent (process emissions) | 0.005 | | same for all years | | kg N2O-nitrogen per kg nitrc | USCP |
| | Nitrification/denitrification process emissions | 0.007 | | same for all years | | kg N2O per person | USCP |
| Transportation | CNG | 0.054 | | same for all years | | kg CO2 per scf | U. S. EPA |
| | CNG - shuttle bus | 0.01 | | same for all years | | kg CH4 per mile | U. S. EPA |
| | CNG - shuttle bus | 0.000001 | | same for all years | | kg N2O per mile | U. S. EPA |
| | biodiesel | 9.45 | | same for all years | | kg biogenic CO2 per gallon | U. S. EPA |
| | biodiesel - shuttle bus | 0.00001 | | same for all years | | kg CH4 per mile | U. S. EPA |
| | biodiesel - shuttle bus | 0.00004 | | same for all years | | kg N2O per mile | U. S. EPA |
| | gasoline | 8.78 | | same for all years | | kg CO2 per gallon | U. S. EPA |
| | gasoline | 0.00038 | | same for all years | | kg CH4 per gallon | U. S. EPA |
| | gasoline | 0.0001 | | same for all years | | kg N2O per gallon | U. S. EPA |
| | diesel | 10.21 | | same for all years | | kg CO2 per gallon | U. S. EPA |
| | diesel | 0.00041 | | same for all years | | kg CH4 per gallon | U. S. EPA |
| | diesel | 0.0001 | | same for all years | | kg N2O per gallon | U. S. EPA |
| | Jet kerosene | 10 | | same for all years | | kg CO2 per gallon | U. S. EPA |
| | Jet kerosene | 0.0004 | | same for all years | | kg CH4 per gallon | U. S. EPA |
| | Jet kerosene | 0.0001 | | same for all years | | kg N2O per gallon | U. S. EPA |
| | Aviation gasoline | 8 | | same for all years | | kg CO2 per gallon | U. S. EPA |
| | Aviation gasoline | 0.0004 | | same for all years | | kg CH4 per gallon | U. S. EPA |
| | Aviation gasoline | 0.0007 | | same for all years | | kg N2O per gallon | U. S. EPA |
| | on-road traffic speed bin 5 | 2,019 | 1,883 | 1,759 | 1,690 | g CO2 per mile | EMFAC 2017 |
| | on-road traffic speed bin 10 | 1,912 | 1,849 | 1,746 | 1,697 | g CO2 per mile | EMFAC 2017 |
| | on-road traffic speed bin 15 | 1,156 | 1,090 | 1,041 | 1,007 | g CO2 per mile | EMFAC 2017 |
| | on-road traffic speed bin 20 | 842 | 770 | 726 | 700 | g CO2 per mile | EMFAC 2017 |
| | on-road traffic speed bin 25 | 548 | 501 | 474 | 453 | g CO2 per mile | EMFAC 2017 |
| | on-road traffic speed bin 30 | 404 | 369 | 345 | 327 | g CO2 per mile | EMFAC 2017 |
| | on-road traffic speed bin 35 | 414 | 377 | 353 | 336 | g CO2 per mile | EMFAC 2017 |
| | on-road traffic speed bin 40 | 393 | 358 | 334 | 317 | g CO2 per mile | EMFAC 2017 |
| | on-road traffic speed bin 45 | 372 | 340 | 316 | 300 | g CO2 per mile | EMFAC 2017 |
| | on-road traffic speed bin 50 | 455 | 411 | 385 | 367 | g CO2 per mile | EMFAC 2017 |
| | on-road traffic speed bin 55 | 442 | 401 | 375 | 357 | g CO2 per mile | EMFAC 2017 |
| | on-road traffic speed bin 60 | 438 | 398 | 371 | 353 | g CO2 per mile | EMFAC 2017 |
| | on-road traffic speed bin 65 | 502 | 457 | 430 | 413 | g CO2 per mile | EMFAC 2017 |
| | on-road traffic speed bin 5 | 0.265 | 0.169 | 0.129 | 0.114 | g CH4 per mile | EMFAC 2017 |
| | on-road traffic speed bin 10 | 0.201 | 0.153 | 0.141 | 0.133 | g CH4 per mile | EMFAC 2017 |
| | on-road traffic speed bin 15 | 0.078 | 0.061 | 0.061 | 0.058 | g CH4 per mile | EMFAC 2017 |
| | on-road traffic speed bin 20 | 0.051 | 0.037 | 0.075 | 0.080 | g CH4 per mile | EMFAC 2017 |
| | on-road traffic speed bin 25 | 0.035 | 0.021 | 0.015 | 0.012 | g CH4 per mile | EMFAC 2017 |
| | on-road traffic speed bin 30 | 0.027 | 0.015 | 0.010 | 0.008 | g CH4 per mile | EMFAC 2017 |
| | on-road traffic speed bin 35 | 0.024 | 0.014 | 0.009 | 0.008 | g CH4 per mile | EMFAC 2017 |
| | on-road traffic speed bin 40 | 0.021 | 0.012 | 0.008 | 0.007 | g CH4 per mile | EMFAC 2017 |
| | on-road traffic speed bin 45 | 0.019 | 0.010 | 0.007 | 0.006 | g CH4 per mile | EMFAC 2017 |
| | on-road traffic speed bin 50 | 0.019 | 0.011 | 0.007 | 0.006 | g CH4 per mile | EMFAC 2017 |
| | on-road traffic speed bin 55 | 0.019 | 0.011 | 0.007 | 0.006 | g CH4 per mile | EMFAC 2017 |
| | on-road traffic speed bin 60 | 0.020 | 0.011 | 0.007 | 0.006 | g CH4 per mile | EMFAC 2017 |
| | on-road traffic speed bin 65 | 0.023 | 0.012 | 0.008 | 0.006 | g CH4 per mile | EMFAC 2017 |
| | on-road traffic speed bin 5 | 0.224 | 0.199 | 0.176 | 0.167 | g N2O per mile | EMFAC 2017 |
| | on-road traffic speed bin 10 | 0.204 | 0.197 | 0.181 | 0.176 | g N2O per mile | EMFAC 2017 |
| | on-road traffic speed bin 15 | 0.093 | 0.085 | 0.078 | 0.076 | g N2O per mile | EMFAC 2017 |
| | on-road traffic speed bin 20 | 0.074 | 0.060 | 0.054 | 0.052 | g N2O per mile | EMFAC 2017 |
| | on-road traffic speed bin 25 | 0.043 | 0.030 | 0.025 | 0.023 | g N2O per mile | EMFAC 2017 |
| | on-road traffic speed bin 30 | 0.029 | 0.017 | 0.012 | 0.010 | g N2O per mile | EMFAC 2017 |
| | on-road traffic speed bin 35 | 0.034 | 0.022 | 0.017 | 0.015 | g N2O per mile | EMFAC 2017 |
| | on-road traffic speed bin 40 | 0.032 | 0.020 | 0.015 | 0.013 | g N2O per mile | EMFAC 2017 |
| | on-road traffic speed bin 45 | 0.028 | 0.017 | 0.012 | 0.010 | g N2O per mile | EMFAC 2017 |
| | on-road traffic speed bin 50 | 0.037 | 0.026 | 0.021 | 0.019 | g N2O per mile | EMFAC 2017 |
| | on-road traffic speed bin 55 | 0.037 | 0.024 | 0.020 | 0.018 | g N2O per mile | EMFAC 2017 |
| | on-road traffic speed bin 60 | 0.035 | 0.022 | 0.017 | 0.015 | g N2O per mile | EMFAC 2017 |
| | on-road traffic speed bin 65 | 0.046 | 0.032 | 0.028 | 0.025 | g N2O per mile | EMFAC 2017 |
| Solid Waste | Mixed MSW in landfill | 0.065 | | same for all years | | MT CH4 per wet short ton | ICLEI ClearPath/WARM |
| | Newspaper in landfill | 0.042 | | same for all years | | MT CH4 per wet short ton | ICLEI ClearPath/WARM |
| | Office paper in landfill | 0.156 | | same for all years | | MT CH4 per wet short ton | ICLEI ClearPath/WARM |
| | Corrugated cardboard in landfill | 0.105 | | same for all years | | MT CH4 per wet short ton | ICLEI ClearPath/WARM |
| | Magazines/Third Class Mail in landfill | 0.048 | | same for all years | | MT CH4 per wet short ton | ICLEI ClearPath/WARM |
| | Food scraps in landfill | 0.065 | | same for all years | | MT CH4 per wet short ton | ICLEI ClearPath/WARM |
| | Grass in landfill | 0.023 | | same for all years | | MT CH4 per wet short ton | ICLEI ClearPath/WARM |
| | Leaves in landfill | 0.026 | | same for all years | | MT CH4 per wet short ton | ICLEI ClearPath/WARM |
| | Branches in landfill | 0.058 | | same for all years | | MT CH4 per wet short ton | ICLEI ClearPath/WARM |
| | Dimensional Lumber in landfill | 0.007 | | same for all years | | MT CH4 per wet short ton | ICLEI ClearPath/WARM |
| | Mixed MSW - landfill gas capture rate | 63% | | same for all years | | percent | ICLEI ClearPath/WARM |
| | Newspaper - landfill gas capture rate | 67% | | same for all years | | percent | ICLEI ClearPath/WARM |
| | Office paper - landfill gas capture rate | 67% | | same for all years | | percent | ICLEI ClearPath/WARM |
| | Corrugated cardboard - landfill gas capture rate | 66% | | same for all years | | percent | ICLEI ClearPath/WARM |
| | Magazines/Third Class Mail - landfill gas capture rate | 67% | | same for all years | | percent | ICLEI ClearPath/WARM |
| | Food scraps - landfill gas capture rate | 65% | | same for all years | | percent | ICLEI ClearPath/WARM |
| | Grass - landfill gas capture rate | 57% | | same for all years | | percent | ICLEI ClearPath/WARM |
| | Leaves - landfill gas capture rate | 64% | | same for all years | | percent | ICLEI ClearPath/WARM |
| | Branches - landfill gas capture rate | 65% | | same for all years | | percent | ICLEI ClearPath/WARM |
| | Dimensional Lumber - landfill gas capture rate | 68% | | same for all years | | percent | ICLEI ClearPath/WARM |
| | Anaerobic digestion process (includes composting of digestate) | 3.788 | | same for all years | | kg CH4 per MT waste | LBNL |
| | Anaerobic digestion process (includes composting of digestate) | 0.023 | | same for all years | | kg biogenic CO2 per MT was | LBNL |
| | Anaerobic digestion process (includes composting of digestate) | 0.009 | | same for all years | | kg N2O per MT waste | LBNL |
| | Oxidation factor | 10% | | same for all years | | percent | ICLEI ClearPath/WARM |
| | Composted green waste | 0.001 | | same for all years | | MT CH4 per short ton | ICLEI ClearPath/WARM |
| | Composted green waste | 0.0002 | | same for all years | | MT N2O per short ton | ICLEI ClearPath/WARM |
| | Composted biowaste | 0.0002 | | same for all years | | MT CH4 per short ton | ICLEI ClearPath/WARM |
| | Composted biowaste | 0.0001 | | same for all years | | MT N2O per short ton | ICLEI ClearPath/WARM |

## ***Table A-2*** *continued*

| SECTOR | SUBSECTOR | Emission Factors 2008 | 2014 | 2017 | 2019 | Units | Source |
|---|---|---|---|---|---|---|---|
| Process and Fugitive | Natural gas energy density | 1,028 | 1,030 | 1,035 | 1,034 | btu per scf | EIA |
| | Natural gas leakage rate in Bay Area | 0.4% | same for all years | | | percent | Jeong et al. 2016 |
| | Natural gas density | 0.8 | same for all years | | | kg per cubic meter | ICLEI ClearPath |
| | Percent $CH_4$ in natural gas | 93.4% | same for all years | | | percent | ICLEI ClearPath |
| | Percent $CO_2$ in natural gas | 1% | same for all years | | | percent | ICLEI ClearPath |
| Forests and trees | Forest remaining forest - undisturbed | -2.100 | -2.100 | -2.100 | -2.100 | MT $CO_2$ per hectare | ICLEI LEARN tool |
| | Forest remaining forest - disturbed by fire | 0.000 | 46.000 | 46.000 | 46.000 | MT $CO_2$ per hectare | ICLEI LEARN tool |
| | Forest remaining forest - disturbed by insects/disease | -2.600 | -2.600 | -2.600 | -2.600 | MT $CO_2$ per hectare | ICLEI LEARN tool |
| | Forest remaining forest - disturbed by harvest/other | 80.200 | 76.900 | 76.900 | 76.900 | MT $CO_2$ per hectare | ICLEI LEARN tool |
| | Forest converted to Cropland | 0.000 | 0.000 | 0.000 | 0.000 | MT $CO_2$ per hectare | ICLEI LEARN tool |
| | Forest converted to Grassland | 0.000 | 37.310 | 37.310 | 37.310 | MT $CO_2$ per hectare | ICLEI LEARN tool |
| | Forest converted to Settlement | 0.000 | 0.000 | 0.000 | 0.000 | MT $CO_2$ per hectare | ICLEI LEARN tool |
| | Forest converted to Wetland | 16.000 | 29.220 | 29.220 | 29.220 | MT $CO_2$ per hectare | ICLEI LEARN tool |
| | Forest converted to Other | 0.000 | 0.000 | 0.000 | 0.000 | MT $CO_2$ per hectare | ICLEI LEARN tool |
| | Non-forest converted to Forest | -1.600 | -1.600 | -1.600 | -1.600 | MT $CO_2$ per hectare | ICLEI LEARN tool |
| | Trees outside forest - canopy maintained/gained | -4.300 | -4.300 | -4.300 | -4.300 | MT $CO_2$ per hectare | ICLEI LEARN tool |
| | Trees outside forest - canopy loss | 91.900 | 78.200 | 78.200 | 78.200 | MT $CO_2$ per hectare | ICLEI LEARN tool |
| Water Delivery | Energy intensity of groundwater extraction | 2,485 | same for all years | | | kWh per million gallons | |
| | Energy intensity of booster pumps | 937 | same for all years | | | kWh per million gallons | CPUC report: Embedded |
| | Energy intensity of raw water pumps | 2 | same for all years | | | kWh per million gallons | Energy in Water Studies, |
| | Energy intensity of water treatment | 33 | same for all years | | | kWh per million gallons | Study 2 |
| | Energy intensity of pressure system pumps | 29 | same for all years | | | kWh per million gallons | |

## ***Table A-3*** *Emissions data (continued on next page)*

| SECTOR | SUBSECTOR | Emissions Data 2008 | 2014 | 2017 | 2018 | 2019 | Scale | Units | Source |
|---|---|---|---|---|---|---|---|---|---|
| On-site electricity generation | SJSU Cogeneration $CO_2$ emissions | 27,374 | 30,286 | 30,533 | | | Facility | MT | CARB Pollution Mapping Tool |
| | SJSU Cogeneration $CH_4$ emissions | 0 | 1 | 1 | | | Facility | MT | CARB Pollution Mapping Tool |
| | SJSU Cogeneration $N_2O$ emissions | 0 | 0 | 0 | | | Facility | MT | CARB Pollution Mapping Tool |
| | SJSU Cogeneration $CO_2e$ emissions | | | | | 30,619 | Facility | MT | CARB MRR |
| | Equinix - Great Oaks Bloom energy servers $CO_2$ emissions | | | | | 30,661 | Facility | MT | CARB Pollution Mapping Tool |
| | Equinix - Lundy Bloom energy servers $CO_2$ emissions | | | | | 10,830 | Facility | MT | CARB Pollution Mapping Tool |
| Other residential fuel use | Statewide Biogenic $CO_2$ emissions from residential wood fuel (wet) | 2,662,794.40 | 4,014,640.00 | 1,888,944.40 | | 2,052,250.20 | Statewide | MT | CARB GHG inventories |
| | Statewide $CH_4$ emissions from residential wood fuel (wet) | 22,710.40 | 34,240.00 | 16,110.40 | | 17,503.20 | Statewide | MT | CARB GHG inventories |
| | Statewide $N_2O$ emissions from residential wood fuel (wet) | 35,530.42 | 53,568.48 | 25,204.72 | | 27,383.76 | Statewide | MT | CARB GHG inventories |
| | Statewide $CO_2$ emissions from residential distillate fuel | 56,543.90 | 38,315.13 | 22,341.98 | | 27,292.13 | Statewide | MT | CARB GHG inventories |
| | Statewide $CH_4$ emissions from residential distillate fuel | 57.34 | 38.85 | 22.66 | | 27.68 | Statewide | MT | CARB GHG inventories |
| | Statewide $N_2O$ emissions from residential distillate fuel | 136.70 | 92.63 | 54.01 | | 65.98 | Statewide | MT | CARB GHG inventories |
| | Statewide $CO_2$ emissions from residential kerosene fuel | 34,476.19 | 25,095.74 | 21,573.00 | | 21,573.00 | Statewide | MT | CARB GHG inventories |
| | Statewide $CH_4$ emissions from residential kerosene fuel | 34.38 | 25.03 | 21.52 | | 21.52 | Statewide | MT | CARB GHG inventories |
| | Statewide $N_2O$ emissions from residential kerosene fuel | 81.97 | 59.67 | 51.29 | | 51.29 | Statewide | MT | CARB GHG inventories |
| | Statewide $CO_2$ emissions from residential LPG fuel | 2,025,184.88 | 1,184,275.92 | 1,391,606.08 | | 1,516,432.44 | Statewide | MT | CARB GHG inventories |
| | Statewide $CH_4$ emissions from residential LPG fuel | 2,411.70 | 1,410.30 | 1,657.20 | | 1,805.85 | Statewide | MT | CARB GHG inventories |
| | Statewide $N_2O$ emissions from residential LPG fuel | 5,749.49 | 3,362.16 | 3,950.76 | | 4,305.15 | Statewide | MT | CARB GHG inventories |
| Transportation | On-road - Google EIE | | | | | | | | |
| | Total emissions from on-road traffic | | | 2,746,499 | | 2,463,769 | Citywide | MT $CO_2e$ | Google EIE |
| | Public transit | | | | | | | | |
| | Systemwide bus emissions | 36,877 | 33,441 | 32,419 | | 27,826 | Regional | MT $CO_2e$ | VTA |
| | Systemwide light rail emissions | 8,103 | 5,030 | 2,335 | | 1,065 | Regional | MT $CO_2e$ | VTA |
| | Systemwide paratransit emissions | 5,391 | 2,530 | 2,477 | | 2,995 | Regional | MT $CO_2e$ | VTA |
| | Freight Rail | | | | | | | | |
| | Statewide rail $CO_2$ emissions (freight + passenger) | 2369444.54 | 2624218.69 | 1822918.15 | | 2208090.30 | Statewide | MT | CARB statewide GHG inventory |
| | Statewide rail $CH_4$ emissions (freight + passenger) | 96.11 | 106.44 | 73.94 | | 89.57 | Statewide | MT | CARB statewide GHG inventory |
| | Statewide rail $N_2O$ emissions (freight + passenger) | 19.22 | 21.29 | 14.79 | | 17.91 | Statewide | MT | CARB statewide GHG inventory |
| | Airport GSE | | | | | | | | |
| | Airport GSE $CO_2$ emissions | 11,484 | | | | | Countywide | MT | EMFAC OFFROAD 2007 |
| | Airport GSE $CH_4$ emissions | 3 | | | | | Countywide | MT | EMFAC OFFROAD 2007 |
| | Airport GSE $N_2O$ emissions | 1 | | | | | Countywide | MT | EMFAC OFFROAD 2007 |
| | Aircraft emissions | | | | | | | | |
| | SJC aircraft $CO_2$ emissions | | | | 137,811 | | Facility | MT | SJC Master Plan EIR |
| | SJC aircraft $CH_4$ emissions | | | | 0.48 | | Facility | MT | SJC Master Plan EIR |
| | SJC aircraft $N_2O$ emissions | | | | 4.20 | | Facility | MT | SJC Master Plan EIR |
| Process and Fugitive | Lumileds LLC $N_2O$ emissions | 0.00 | 0.97 | 0.00 | | 0.00 | Facility | MT | U. S. EPA GHGRP Subpart I/FLIGHT |
| | Lumileds LLC PFC-14 emissions | 0.06 | 0.00 | 0.00 | | 0.00 | Facility | MT | U. S. EPA GHGRP Subpart I/FLIGHT |
| | Lumileds LLC PFC-116 emissions | 0.00 | 0.01 | 0.00 | | 0.00 | Facility | MT | U. S. EPA GHGRP Subpart I/FLIGHT |
| | Maxim Integrated Products $N_2O$ emissions | 3.08 | 1.79 | 0.00 | | 0.00 | Facility | MT | U. S. EPA GHGRP Subpart I/FLIGHT |
| | Maxim Integrated Products $SF_6$ emissions | 0.02 | 0.07 | 0.00 | | 0.00 | Facility | MT | U. S. EPA GHGRP Subpart I/FLIGHT |
| | Maxim Integrated Products PFC-14 emissions | 1.09 | 0.17 | 0.00 | | 0.00 | Facility | MT | U. S. EPA GHGRP Subpart I/FLIGHT |
| | Maxim Integrated Products Perfluorocyclobutane emissions | 0.02 | 0.03 | 0.00 | | 0.00 | Facility | MT | U. S. EPA GHGRP Subpart I/FLIGHT |
| | Maxim Integrated Products PFC C-1418 emissions | 0.00 | 0.02 | 0.00 | | 0.00 | Facility | MT | U. S. EPA GHGRP Subpart I/FLIGHT |
| | Maxim Integrated Products $NF_3$ emissions | 0.05 | 0.01 | 0.00 | | 0.00 | Facility | MT | U. S. EPA GHGRP Subpart I/FLIGHT |
| | Maxim Integrated Products PFPMIE (HT-70) emissions | 0.00 | 0.06 | 0.00 | | 0.00 | Facility | MT | U. S. EPA GHGRP Subpart I/FLIGHT |
| | Maxim Integrated Products HFC-23 emissions | 0.06 | 0.02 | 0.00 | | 0.00 | Facility | MT | U. S. EPA GHGRP Subpart I/FLIGHT |
| | Maxim Integrated Products PFC-116 emissions | 0.42 | 0.10 | 0.00 | | 0.00 | Facility | MT | U. S. EPA GHGRP Subpart I/FLIGHT |
| | Maxim Integrated Products HT-135 emissions | 0.00 | 0.07 | 0.00 | | 0.00 | Facility | MT | U. S. EPA GHGRP Subpart I/FLIGHT |
| | Maxim Integrated Products PFC-218 emissions | 1.26 | 0.00 | 0.00 | | 0.00 | Facility | MT | U. S. EPA GHGRP Subpart I/FLIGHT |
| | Maxim Integrated Products HFC-32 emissions | 0.00 | 0.00 | 0.00 | | 0.00 | Facility | MT | U. S. EPA GHGRP Subpart I/FLIGHT |
| | Micrel LLC $N_2O$ emissions | 7.09 | 4.53 | 0.00 | | 0.00 | Facility | MT | U. S. EPA GHGRP Subpart I/FLIGHT |
| | Micrel LLC PFC-14 emissions | 0.63 | 0.72 | 0.00 | | 0.00 | Facility | MT | U. S. EPA GHGRP Subpart I/FLIGHT |
| | Micrel LLC PFC-116 emissions | 1.37 | 1.43 | 0.00 | | 0.00 | Facility | MT | U. S. EPA GHGRP Subpart I/FLIGHT |
| | Micrel LLC Perfluorocyclobutane emissions | 0.02 | 0.01 | 0.00 | | 0.00 | Facility | MT | U. S. EPA GHGRP Subpart I/FLIGHT |
| | Micrel LLC HT-135 emissions | 0.01 | 0.01 | 0.00 | | 0.00 | Facility | MT | U. S. EPA GHGRP Subpart I/FLIGHT |
| | Micrel LLC HFC-23 emissions | 0.05 | 0.06 | 0.00 | | 0.00 | Facility | MT | U. S. EPA GHGRP Subpart I/FLIGHT |
| | Micrel LLC $NF_3$ emissions | 0.01 | 0.04 | 0.00 | | 0.00 | Facility | MT | U. S. EPA GHGRP Subpart I/FLIGHT |
| | Micrel LLC $SF_6$ emissions | 0.06 | 0.13 | 0.00 | | 0.00 | Facility | MT | U. S. EPA GHGRP Subpart I/FLIGHT |
| | Micrel LLC PFC C-1418 emissions | 0.00 | 0.00 | 0.00 | | 0.00 | Facility | MT | U. S. EPA GHGRP Subpart I/FLIGHT |
| | $SF_6$ emissions | 0.31 | 0.18 | 0.19 | | 0.14 | Statewide | million MT $CO_2e$ | CARB statewide inventory |
| | Commercial HFCs and PFCs | 3.62 | 7.42 | 8.62 | | 8.73 | Statewide | million MT $CO_2e$ | CARB statewide inventory |
| | Industrial HFCs and PFCs | 1.46 | 2.16 | 2.47 | | 2.58 | Statewide | million MT $CO_2e$ | CARB statewide inventory |
| | Residential HFCs and PFCs | 0.82 | 2.39 | 3.29 | | 3.60 | Statewide | million MT $CO_2e$ | CARB statewide inventory |
| | Transportation HFCs and PFCs | 4.62 | 4.45 | 4.08 | | 3.97 | Statewide | million MT $CO_2e$ | CARB statewide inventory |

## ***Table A-3*** *continued*

| SECTOR | SUBSECTOR | Emissions Data 2008 | 2014 | 2017 | 2018 | 2019 | Scale | Units | Source |
|---|---|---|---|---|---|---|---|---|---|
| Wastewater | Digester gas | 16 | 79 | 75 | | 89 | Facility | MT CO2e | Wastewater Facility |
| | Landfill gas | 12 | 0 | 0 | | 0 | Facility | MT CO2e | Wastewater Facility |
| | Natural gas | 16,854 | 24,368 | 19,315 | | 21,572 | Facility | MT CO2e | Wastewater Facility |
| | Diesel fuel | 278 | 297 | 172 | | 218 | Facility | MT CO2e | Wastewater Facility |
| Electricity generated for supply to the electric grid | Calpine - Metcalf Energy CO2 emissions | 1,277,804.00 | 969,762.00 | 814,183.00 | | | Facility | MT | CARB Pollution Mapping Tool |
| | Calpine - Metcalf Energy CH4 emissions | 21.33 | 18.29 | 15.36 | | | Facility | MT | CARB Pollution Mapping Tool |
| | Calpine - Metcalf Energy N2O emissions | 2.37 | 1.83 | 1.54 | | | Facility | MT | CARB Pollution Mapping Tool |
| | Calpine - Metcalf Energy CO2e emissions | | | | | 996,791.00 | Facility | MT | CARB MRR |
| | Calpine - Los Esteros Energy CO2 emissions | 45,950.00 | 109,928.00 | 101,521.00 | | | Facility | MT | CARB Pollution Mapping Tool |
| | Calpine - Los Esteros Energy CH4 emissions | 0.77 | 2.07 | 1.92 | | | Facility | MT | CARB Pollution Mapping Tool |
| | Calpine - Los Esteros Energy N2O emissions | 0.08 | 0.21 | 0.19 | | | Facility | MT | CARB Pollution Mapping Tool |
| | Calpine - Los Esteros Energy CO2e emissions | | | | | 97,548.00 | Facility | MT | CARB MRR |
| | Calpine - O.L.S. Energy CO2 emissions | 96,560.00 | 7,835.00 | 10,731.00 | | | Facility | MT | CARB Pollution Mapping Tool |
| | Calpine - O.L.S. Energy CH4 emissions | 1.64 | 0.15 | 0.20 | | | Facility | MT | CARB Pollution Mapping Tool |
| | Calpine - O.L.S. Energy N2O emissions | 0.18 | 0.02 | 0.02 | | | Facility | MT | CARB Pollution Mapping Tool |
| | Calpine - O.L.S. Energy CO2e emissions | | | | | 3,514.00 | Facility | MT | CARB MRR |
| | Newby Island Gas Recovery CO2 emissions | 0.00 | | | | | Facility | MT | CARB Pollution Mapping Tool |
| | Newby Island Gas Recovery CH4 emissions | 0.23 | | | | | Facility | MT | CARB Pollution Mapping Tool |
| | Newby Island Gas Recovery N2O emissions | 0.03 | | | | | Facility | MT | CARB Pollution Mapping Tool |
| | Newby Island II Gas Recovery CO2 emissions | 0.00 | | | | | Facility | MT | CARB Pollution Mapping Tool |
| | Newby Island II Gas Recovery CH4 emissions | 0.23 | | | | | Facility | MT | CARB Pollution Mapping Tool |
| | Newby Island II Gas Recovery N2O emissions | 0.03 | | | | | Facility | MT | CARB Pollution Mapping Tool |
| | Guadalupe Gas Recovery CO2 emissions | 31,412.00 | 0.00 | 0.00 | | 0.00 | Facility | MT | CARB Pollution Mapping Tool |
| | Guadalupe Gas Recovery CH4 emissions | 0.27 | 0.00 | 0.00 | | 0.00 | Facility | MT | CARB Pollution Mapping Tool |
| | Guadalupe Gas Recovery N2O emissions | 0.03 | 0.00 | 0.00 | | 0.00 | Facility | MT | CARB Pollution Mapping Tool |

## ***Table A-4*** *Scaling factors (continued on next page)*

| SECTOR | SUBSECTOR | Scaling Factor 2008 | 2014 | 2017 | 2018 | 2019 | Scale | Source |
|---|---|---|---|---|---|---|---|---|
| Other residential fuel use | Number of California households using wood for heating | 222,490 | 217,723 | 208,846 | | 198,102 | Statewide | American Community Survey |
| | Number of California households using fuel oil, kerosene, etc for heating | 41,453 | 34,168 | 31,590 | | 31,508 | Statewide | American Community Survey |
| | Number of California households using bottled, tank, or LPG for heating | 413,742 | 398,409 | 415,492 | | 422,508 | Statewide | American Community Survey |
| | Number of San Jose households using wood for heating | 1,143 | 661 | 683 | | 632 | Citywide | American Community Survey |
| | Number of San Jose households using fuel oil, kerosene, etc for heating | 208 | 172 | 178 | | 195 | Citywide | American Community Survey |
| | Number of San Jose households using bottled, tank, or LPG for heating | 3,169 | 3,271 | 3,948 | | 4,032 | Citywide | American Community Survey |
| Wastewater | Wastewater Facility service population | 1,400,000 | 1,400,000 | 1,400,000 | | 1,500,000 | Facility | Wastewater Facility |
| | San Jose population | 923,491 | 1,012,694 | 1,045,047 | | 1,047,871 | Citywide | California Department of Finance |
| | Public Transit | | | | | | | |
| | Santa Clara County population + jobs | 2614748 | 2863457 | 3007821 | | 3049694 | Countywide | California Department of Finance/ U. S. Census OnTheMap |
| | San Jose population + jobs | 1272592 | 1409014 | 1475157 | | 1490736 | Citywide | California Department of Finance/ U. S. Census OnTheMap |
| | Caltrain | | | | | | | |
| | Total system miles | 77 | | same for all years | | | Systemwide | Caltrain 2019 sustainability report (includes miles to Gilroy) |
| | Track miles in San Jose | 4.72 | | same for all years | | | Citywide | GIS analysis |
| | ACE | | | | | | | |
| | Total system miles | 86 | | same for all years | | | Systemwide | ACE website |
| | Track miles in San Jose | 6.64 | | same for all years | | | Citywide | GIS analysis |
| | Amtrak/Capitol Corridor | | | | | | | |
| | Total system miles | 169 | | same for all years | | | Systemwide | 2018 California State rail plan |
| | Track miles in San Jose | 6.64 | | same for all years | | | Citywide | GIS analysis |
| | Freight Rail | | | | | | | |
| | Total system miles | 5295 | | same for all years | | | Statewide | 2018 California State rail plan |
| | Track miles in San Jose | 36.85 | | same for all years | | | Citywide | GIS analysis |
| Transportation | Offroad | | | | | | | |
| | Santa Clara County Agriculture, Forestry, Fishing and Hunting Jobs | 3,170 | 3,169 | 2,969 | | 2,841 | Countywide | U. S. Census OnTheMap |
| | Santa Clara County Mining, Quarrying, and Oil and Gas Extraction Jobs | 334 | 290 | 256 | | 210 | Countywide | U. S. Census OnTheMap |
| | Santa Clara County Utilities Jobs | 3,585 | 3,830 | 4,182 | | 3,326 | Countywide | U. S. Census OnTheMap |
| | Santa Clara County Construction Jobs | 42,402 | 39,114 | 49,462 | | 50,334 | Countywide | U. S. Census OnTheMap |
| | Santa Clara County Manufacturing Jobs | 141,481 | 150,467 | 153,615 | | 161,910 | Countywide | U. S. Census OnTheMap |
| | Santa Clara County Wholesale Trade Jobs | 42,447 | 40,871 | 39,985 | | 37,139 | Countywide | U. S. Census OnTheMap |
| | Santa Clara County Retail Trade Jobs | 80,535 | 84,449 | 83,730 | | 82,554 | Countywide | U. S. Census OnTheMap |
| | Santa Clara County Transportation and Warehousing Jobs | 13,498 | 14,957 | 18,931 | | 16,854 | Countywide | U. S. Census OnTheMap |
| | Santa Clara County Information Jobs | 43,611 | 69,828 | 85,199 | | 88,664 | Countywide | U. S. Census OnTheMap |
| | Santa Clara County Finance and Insurance Jobs | 19,708 | 22,011 | 21,411 | | 21,590 | Countywide | U. S. Census OnTheMap |
| | Santa Clara County Real Estate and Rental and Leasing Jobs | 14,578 | 13,066 | 14,260 | | 15,178 | Countywide | U. S. Census OnTheMap |
| | Santa Clara County Professional, Scientific, and Technical Services Jobs | 111,124 | 133,488 | 151,554 | | 158,080 | Countywide | U. S. Census OnTheMap |
| | Santa Clara County Management of Companies and Enterprises Jobs | 9,842 | 12,106 | 13,715 | | 19,227 | Countywide | U. S. Census OnTheMap |
| | Santa Clara County Administration & Support, Waste Management and Remediation Jobs | 54,564 | 61,442 | 66,160 | | 64,382 | Countywide | U. S. Census OnTheMap |
| | Santa Clara County Educational Services Jobs | 71,375 | 76,904 | 82,051 | | 81,909 | Countywide | U. S. Census OnTheMap |
| | Santa Clara County Health Care and Social Assistance Jobs | 79,520 | 111,701 | 126,770 | | 134,179 | Countywide | U. S. Census OnTheMap |
| | Santa Clara County Arts, Entertainment, and Recreation Jobs | 12,784 | 14,863 | 17,585 | | 17,835 | Countywide | U. S. Census OnTheMap |
| | Santa Clara County Accommodation and Food Services Jobs | 65,214 | 75,385 | 83,302 | | 88,228 | Countywide | U. S. Census OnTheMap |
| | Santa Clara County Other Services (excluding Public Administration) Jobs | 36,957 | 25,620 | 28,514 | | 29,072 | Countywide | U. S. Census OnTheMap |
| | Santa Clara County Public Administration Jobs | 20,107 | 22,817 | 21,994 | | 21,349 | Countywide | U. S. Census OnTheMap |
| | San Jose Agriculture, Forestry, Fishing and Hunting Jobs | 516 | 454 | 434 | | 431 | Citywide | U. S. Census OnTheMap |
| | San Jose Mining, Quarrying, and Oil and Gas Extraction Jobs | 159 | 122 | 136 | | 66 | Citywide | U. S. Census OnTheMap |
| | San Jose Utilities Jobs | 1,992 | 2,073 | 1,987 | | 2,016 | Citywide | U. S. Census OnTheMap |
| | San Jose Construction Jobs | 21,337 | 19,941 | 26,180 | | 26,736 | Citywide | U. S. Census OnTheMap |
| | San Jose Manufacturing Jobs | 41,442 | 55,900 | 51,768 | | 53,935 | Citywide | U. S. Census OnTheMap |
| | San Jose Wholesale Trade Jobs | 16,180 | 16,487 | 16,831 | | 17,087 | Citywide | U. S. Census OnTheMap |
| | San Jose Retail Trade Jobs | 36,282 | 40,117 | 40,845 | | 40,854 | Citywide | U. S. Census OnTheMap |
| | San Jose Transportation and Warehousing Jobs | 9,507 | 10,062 | 13,771 | | 11,139 | Citywide | U. S. Census OnTheMap |
| | San Jose Information Jobs | 8,483 | 11,207 | 14,005 | | 15,176 | Citywide | U. S. Census OnTheMap |
| | San Jose Finance and Insurance Jobs | 7,933 | 10,831 | 11,142 | | 11,558 | Citywide | U. S. Census OnTheMap |
| | San Jose Real Estate and Rental and Leasing Jobs | 7,256 | 5,906 | 6,892 | | 6,669 | Citywide | U. S. Census OnTheMap |
| | San Jose Professional, Scientific, and Technical Services Jobs | 32,682 | 39,019 | 42,325 | | 43,060 | Citywide | U. S. Census OnTheMap |
| | San Jose Management of Companies and Enterprises Jobs | 5,154 | 4,389 | 5,225 | | 5,730 | Citywide | U. S. Census OnTheMap |
| | San Jose Administration & Support, Waste Management and Remediation Jobs | 30,061 | 33,293 | 36,850 | | 38,435 | Citywide | U. S. Census OnTheMap |
| | San Jose Educational Services Jobs | 26,794 | 30,557 | 33,187 | | 32,779 | Citywide | U. S. Census OnTheMap |
| | San Jose Health Care and Social Assistance Jobs | 34,878 | 50,853 | 56,070 | | 62,826 | Citywide | U. S. Census OnTheMap |
| | San Jose Arts, Entertainment, and Recreation Jobs | 5,959 | 7,197 | 8,055 | | 8,398 | Citywide | U. S. Census OnTheMap |
| | San Jose Accommodation and Food Services Jobs | 28,434 | 32,424 | 36,150 | | 37,883 | Citywide | U. S. Census OnTheMap |
| | San Jose Other Services (excluding Public Administration) Jobs | 19,124 | 10,877 | 13,231 | | 13,690 | Citywide | U. S. Census OnTheMap |
| | San Jose Public Administration Jobs | 14,928 | 14,611 | 15,026 | | 14,397 | Citywide | U. S. Census OnTheMap |
| | Aviation | | | | | | | |
| | SJC - total number of local flight operations | 15,627 | 4,547 | 4,446 | 3,612 | 3,265 | Facility | FAA ATADS |
| | SJC - total number of non-local flight operations | 175,509 | 137,664 | 174,149 | 192,015 | 202,621 | Facility | FAA ATADS |
| | RHV - total number of local flight operations | 89,386 | 79,555 | 90,071 | | 122,376 | Facility | FAA ATADS |
| | RHV - total number of non-local flight operations | 51,620 | 55,771 | 72,577 | | 85,824 | Facility | FAA ATADS |
| | SJC - total number of arriving and departing passengers | 9471817 | 9205612 | 12147990 | | 14622126 | Facility | SJC Airport Activity Reports |
| | SJC - total number of connecting passengers | 245900 | 179600 | 332242 | | 1028318 | Facility | SJC Airport Activity Reports |
| | On-road | | | | | | | |
| | On-road traffic annualization factor | 346 | 335 | 351 | | 352 | Citywide | PeMS |

## **Table A-4** *continued*

| SECTOR | SUBSECTOR | Scaling Factor 2008 | 2014 | 2017 | 2018 | 2019 | Scale | Source |
|---|---|---|---|---|---|---|---|---|
| Process and Fugitive | Fugitive SF6 | | | | | | | |
| | California population | 36,704,375 | 38,556,731 | 39,398,702 | | 39,695,376 | Statewide | CA Department of Finance |
| | San Jose population | 923,491 | 1,012,694 | 1,045,047 | | 1,047,871 | Citywide | CA Department of Finance |
| | HFCs and PFCs | | | | | | | |
| | California Industrial jobs | 2,636,534 | 2,457,799 | 2,639,360 | | 2,693,988 | Statewide | U. S. Census OnTheMap |
| | California Commercial jobs | 11,574,431 | 12,672,167 | 13,586,972 | | 13,832,241 | Statewide | U. S. Census OnTheMap |
| | California Transportation jobs | 458,943 | 484,700 | 587,893 | | 632,447 | Statewide | U. S. Census OnTheMap |
| | San Jose Industrial jobs | 65,446 | 78,490 | 80,505 | | 83,184 | Citywide | U. S. Census OnTheMap |
| | San Jose Commercial jobs | 274,148 | 307,768 | 335,834 | | 348,542 | Citywide | U. S. Census OnTheMap |
| | San Jose Transportation jobs | 9,507 | 10,062 | 13,771 | | 11,139 | Citywide | U. S. Census OnTheMap |

## **Table A-5** *GWP values*

| | GHG | Value | Source |
|---|---|---|---|
| Global Warming Potentials (GWPs) | CH4 | 28 | IPCC 5th Assessment Report |
| | N2O | 265 | IPCC 5th Assessment Report |
| | PFC-14 | 6630 | IPCC 5th Assessment Report |
| | PFC-116 | 11100 | IPCC 5th Assessment Report |
| | SF6 | 23500 | IPCC 5th Assessment Report |
| | Perfluorocyclobutane (PFC-318) | 9540 | IPCC 5th Assessment Report |
| | PFC C-1418 (perfluorocyclopentene, c-C5F8) | 2 | IPCC 5th Assessment Report |
| | NF3 | 16100 | IPCC 5th Assessment Report |
| | PFPMIE (HT-70) | 9710 | IPCC 5th Assessment Report |
| | HFC-23 | 12400 | IPCC 5th Assessment Report |
| | HT-135 (default GWP for fully fluorinated GHGs) | 10000 | Table A-1 to Subpart A of the GHGRP regulation - 40 CRP Part 98 |
| | PFC-218 | 8900 | IPCC 5th Assessment Report |
| | HFC-32 | 677 | IPCC 5th Assessment Report |

## **Table A-6** *Facilities in San José covered by state and federal GHG reporting requirements*

| Facility | Address | CARB ID | U. S. EPA ID | Included in this inventory? |
|---|---|---|---|---|
| San Jose/Santa Clara Regional Wastewater Facility | 700 Los Esteros Road, San Jose, CA 95134 | 101140 | 1012097 | Yes - Wastewater treatment |
| San Jose Clean Energy | | 104793 | | Yes - Emission factors |
| HGST, Inc (Hitachi Global Storage Technologies - now Western Digital) | 5601 Great Oaks Parkway , San Jose, CA 95119 | 104360 | | Yes - assumed included in PG&E activity data |
| Santa Clara Valley Medical Center | 751 S. Bascom Ave. , San Jose, CA 95128 | 104626 | | Yes - assumed included in PG&E activity data |
| California State University, San Jose | 260 S. 9th St, San Jose, CA 95192 | 100131 | 1011772 | Yes - Onsite electricity generation |
| Equinix Great Oaks - Bloom Energy Servers | 9 Great Oaks Blvd , San Jose, CA 95119 | 104787 | | Yes - Onsite electricity generation |
| Equinix Lundy - Bloom Energy Servers | 1735 Lundy Ave , San Jose, CA 95131 | 104788 | | Yes - Onsite electricity generation |
| Calpine - Metcalf Energy Center, LLC | 1 Blanchard Road, San Jose, CA 95013 | 100343 | | Yes - Electricity generated for supply to electric grid |
| Newby Island II, 95134 | 1804 Dixon Landing Road, San Jose, CA 95002 | 101023 | | Yes - Electricity generated for supply to electric grid |
| Calpine - Los Esteros Critical Energy Facility, LLC | 800 Thomas Foon Chew Way, San Jose, CA 95143 | 101143 | 1000175 | Yes - Electricity generated for supply to electric grid |
| Calpine - O.L.S. Energy - Agnews Inc. 95134 | 3800 Cisco Way, San Jose, CA 95134 | 101426 | 1005975 | Yes - Electricity generated for supply to electric grid |
| Newby Island , 95134 | 1804 Dixon Landing Road, San Jose, CA 95002 | 101658 | | Yes - Electricity generated for supply to electric grid |
| Gas Recovery Systems LLC - Guadalupe | 15999 Guadalupe Mines Road, San Jose, CA 95120 | 101713 | | Yes - Electricity generated for supply to electric grid |
| Pacific Gas and Electric Company (PG&E) | | 3002 | | Yes - Emission factors |
| Philips Lumileds Lighting, Inc | 370 W Trimble Road | | 1011905 | Yes - Industrial process emissions |
| Micrel Semiconductor Inc | 1849 Fortune Drive | | 1011819 | Yes - Industrial process emissions |
| Maxim Integrated Products, Incorporated | 3725 N 1st Street | | 1009983 | Yes - Industrial process emissions |
| Guadalupe Rubbish Disposal | 15999 Guadalupe Mines Rd | | 1007837 | Yes - emissions from solid waste generated in San Jose only |